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JAMES H. McGRAW
President

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Government Control of Power

GOVERNMENT control of the supply of power in some communities is not now a matter of academic discussion, it is a fact. That this is so is no surprise to foreseeing observers. It has been long ago forecast in these columns and has been hastened by the tremendous needs of the war industries, by the dangerously progressing margin between the quantity of power produced and the quantity of power wanted, and by the apparently insoluble problem of getting the necessary coal out of the mines and moving it without delay to the points where it is wanted.

Now that the situation has developed to the extent where a system of virtual priority is in effect in some cities and the national need for power is very acute, it is high time to make clear again the critical nature of the emergency that confronts us. In brief, we have the war forces of the government bending every resource with vigor to hasten the manufacture of munitions. We have another government agency in responsible control of the conditions of coal production and, in general, coal distribution and allocation as between different classes of clamoring consumers. The Fuel Administration effort is now supplemented by complete federal control of railroad operation. The sum total of these factors is that we have the government, through those who are producing munitions for it, as consumer, and we have the government as the supreme authority over coal supply. All that is required of the steam electric central station is that it shall take the coal supplies which the government will provide and convert them into the energy which the government (or those to whom it awards contracts) will buy.

The field of activity is thus so narrow that the central station will have to move diligently and with extreme circumspection in order to measure up to the exacting standards that the nation sets. Its aim will be to serve the national interest. If the government orders it to furnish power to certain industries and compliance means cutting off other consumers, there is no patriotic course but to obey. Such an order means discrimination under the state law.

When because of urgent war needs the federal authorities order discrimination they should be asked to put their requirements in writing. Companies will find it advisable to take up with the public service commissions all questions involving discrimination under state laws. These commissions will act as patriotically as any citizens, but their action will keep the records straight for the lawyers or courts in case of future question. The main thing will be to divert the power unhesitatingly, as the government desires to have it done, but, in doing that, the companies will want clear authority for all drastic steps.

Transportation and Fuel Supply

THE United States government has tackled the biggest job of its career in taking over the railroads. It can thus effect a working merger far closer than anything which would have been permitted to the railroads themselves, and much more efficient, because the question of funds for adequate supply of rolling stock is thereby automatically settled. We earnestly hope that one of the immediate results will be the clearing up of the fuel transportation difficulty, for which no effective cure has hitherto been found. A shortage of fuel in these times is perfectly understandable, yet a breakdown of fuel transportation so serious that factories have to close, schools shut down and power plants run on reduced output is a state of affairs that, broadly, is not excusable. It is now rigorously up to the government to take hold with a firm hand and put its task through even if it has to commandeer the coal mines and enlist the miners to do it.

Every patriot, whether he theoretically believes in government ownership or not, must recognize that it gives opportunity for efficient action which is well worth the while, and should give it full support even to the extent of forgoing the inalienable right of grumbling at inconveniences. These there will undoubtedly be in the rearrangement required to do effectively the things which are necessary. We in this country have yet to learn the lesson that war is a serious business to which private prejudices and interests must give way. We believe that the government by this step will be able to carry out the work of national defence as it could not possibly have carried it out otherwise, and at a speed utterly impossible so long as the transportation systems were not welded into one coherent whole.

Developments in Electrical Industry in 1917

Very Little Progress Made in the Art—Every Energy Bent on Increasing Production and Keeping Essential Industries Going

NO GREAT amount of space is necessary to record the scientific and technical achievements of the past year. With a world-wide war on our hands and with the electrical industry straining every nerve and muscle to meet demands in the face of shortage of labor, material, fuel and transportation, advances, save in isolated cases, have been out of the question. Development has taken place rather in the direction of increased production or the same output against heavy odds.

Great Production of Electricity

The central-station industry turned out more electricity than ever, despite serious handicaps for want of fuel and apparatus in addition to a lack of money for betterments and extensions. Statistics gathered by the Electrical World indicate that the total central-station output for the year was approximately 27,000,000,000 kw.-hr. More than half of this energy, and we record this with pride, was developed from water power. To develop the rest in steam stations required approximately only 4 per cent of the country's total coal supply, but great difficulty was experienced in securing that small percentage. By and large, the quality of central-station service has not been permitted to deteriorate, although the great bulk of energy is still being sold at the regular pre-war rates. In some instances increased rates have been allowed.

Manufacturers Overloaded

Manufacturers of electrical apparatus and supplies have been busily engaged in turning out equipment, but have been unable to meet even very urgent demands. The government has been a large buyer. In fact, the demands of the government upon electrical manufacturers have caused many to subordinate all developments in other directions. Some manufacturers are working 100 per cent in excess of their previous maximum output, the pressure being in part for electrical products and in part for munitions and other war supplies.

Jobbing Conditions Excellent

The year 1917 was the most prosperous in the history of the electrical supply business. This has been particularly true in the industrial centers. The net merchandise profit by reason of increase in values has been larger than for many years past, and the constant rise in values of all merchandise except copper has given an additional and very substantial warehouse profit. During the first six months of the year particularly, the number of orders handled, which after all is a truer indication of the health of the business, showed a substantial increase over the similar period in 1916.

The electrical supply jobbers face the year 1918 with the sure knowledge that building operations as a whole, outside of construction for government purposes, will be approximately 50 per cent of normal, with a corresponding decrease of about 50 per cent in the purchasing power of the contractors. The financial needs of the government, coupled with the uncertainty as to demands of labor for higher wages, will make it difficult for public utilities to secure money for extensions except at a very high rate. This naturally will be reflected in less new work and fewer extensions, with a corresponding decrease in purchases.

Broader Field for Contractors

During the year the electrical contractors have broadened their organization plans by the adoption of a new constitution and by-laws, which have since been ratified by enough state organizations to bring into existence the National Association of Electrical Contractors and Dealers. The organization seeks better standards of practice among contractors, better trade relations between the various national bodies, and, above all, will strive to make the contractor himself a better merchant. Normal electrical contracting work suffered a decline during the year for obvious reasons.

Research Work

Research has made good progress, although the lines of endeavor have been considerably different from what they would have been had we not entered the war. As it is, many research men have been devoting their energies to solving war problems, and while it is manifestly impossible to give out results of this type of research, we know that splendid progress has been made. The devotion and energy displayed by research men who are giving their time, many practically without compensation, to government work is most inspiring. In many lines it has been found necessary to do intensified research work to provide substitutes for materials which have been withdrawn from the market or which have become unduly expensive. In fact, the direct war research work is no more important than the indirect work in providing industry with the ways and means of keeping production going in spite of abnormal conditions in regard to materials, etc.

Turbines and Waterwheels

Experience in the last twelve months indicates that the tendency on the part of operators to purchase steam-turbine units of large capacities will continue. With a view to improving economies still further in addition to increasing the size of the units, the present drift is in the direction of high steam pressure with superheat. This necessitates a more extensive use of cast steel and bronze alloys not subject to the growing action experienced in cast iron subject to higher temperatures. The lines of small steam turbines have been improved in the standardization of the several types. Superfluous sizes and frames have been eliminated, except that certain special designs have been quickly developed and are being supplied to the government in large quantities. Considerable progress has also been made in the adoption of the small steam turbine to very high-temperature steam.

Waterwheel business has fallen off during the past year. However, on account of the scarcity and high price of coal and the growing conviction that if coal is to be conserved the water powers of the country must be developed, renewed activity in hydroelectric developments is anticipated. The falling off in waterwheel business has been due to lack of new developments, reconstruction work remaining about the same, while more extensions were made in 1917 than in 1916. A test recently made on a 5250-hp. horizontal water turbine installed in a paper mill in Maine showed a maximum efficiency of 92.3 per cent. This is considered to be the highest efficiency that has ever been obtained in a horizontal unit. A vertical unit, it will be remembered, showed on test several years ago an efficiency of 93.7 per cent, this latter being, as far as we know, the highest efficiency which has ever been obtained in a waterwheel.

GENERATORS AND TRANSFORMERS

There have been no radical changes in the design of alternating-current generators other than the continued effort to understand and predict temperatures more correctly, thereby reducing the size and the cost of the machines. Even though stresses may be a serious limitation in turbo-generators in the large high-speed units, they seldom if ever are as important as magnetic saturation or temperature rise.

Transformers, especially of the high-tension type, have been a scarcity on the market during the year, and in general manufacturers of transformers have been bending all efforts to increase production. More confidence is placed in large transformer units, and during the year a 8000-kva., 44,000/6600-volt, 60-cycle, self-cooled transformer was installed in a steel mill in Ohio. This unit, both in its rating and in its over-all dimensions, is a distinct advance in the maximum size of self-cooled units. As indicative of the lack of hesitancy on the part of customers to order transformers of very large size, the case of the Detroit Edison Company may be cited. That company has a 25,000-kva. auto-transformer which will transform 12,000 volts to 24,000 volts. Being an auto-transformer, this means that the unit will control an output of 50,000 kva., an amount of power that no one has heretofore been willing to make dependent on a single static transformation.

TRANSMISSION PROBLEMS

Despite unusual conditions there has been great progress made in the manufacture of high-tension insulators. It would seem that more substantial progress has been made last year than at any other time in the last six or seven years. The realization that an insulator involves many factors other than size and weight has done much to permit development along lines which increase reliability and lower the cost of maintenance.

One of the most important problems confronting the electrical industry at the present time relates to continuity of service. It is perfectly evident that if implicit reliance could be placed on transmitted power huge steam generating stations could be more strategically located with reference to coal supply, thereby releasing many coal cars and permitting economies in other directions.

Lightning troubles we shall perhaps always have, but other line troubles are gradually being eliminated. At the present time the cost of protective apparatus is too large a percentage of the cost of power and switching apparatus in smaller systems, and yet a small installation without protective apparatus menaces the continuity of the main power supply. During the year a new type of arrester, which has the critical voltage characteristics of the aluminum arrester and yet is entirely dry and requires no charging, has been developed. Further developments have also taken place in the building of power reactances cast in concrete.

GREAT DEMAND FOR MOTORS

In the motor market the demand for large as well as for small motors has exceeded the supply. As a consequence there has been no room for any but standard apparatus. Changes have been kept down to a minimum. In machines intended for steel mills the insulation of windings in both motors and generators has been increased so as to secure a greater margin of safety to offset the severe conditions of operation.

Owing to fuel and other conditions a great many manufacturers have turned to electric drive, thereby increasing the normal demand for motors as well as the demand for energy from central-station circuits. The pressure for standard motors is still heavy. Even with fractional horsepower motors, where the government purchases have been comparatively small, sufficient minor operations have developed in essential industries to keep up an abnormal production.

Naturally with the great demand for electric motors there is a similar demand for controllers, and the same general condition of increased production of standard product prevails in the controller field.

This year has witnessed a number of important developments in electric storage batteries, especially for government use, but under present conditions we are not at liberty to discuss these.

WIRE AND CABLES

Wire and cable manufacturers have been very prosperous during the year. The demand for wire and cable even outside of that required for government use has been very satisfactory. Of course, if money continues to be so hard to get and the prices of building materials remain so high, the public utilities will not be inclined to make extensions and normal building operations will remain at a standstill. There remains, however, a large business due to necessary extensions, and there is considerable other development work under way which will call for large quantities of wire and cable.

STANDARDIZATION

The work of standardization during the past year has been confined more to slight revisions of former standards than to any radically new line of work. Horsepower ratings have been adopted for direct-current adjustable-speed motors. Transformer rules covering distribution and power transformers have been finally approved on the subjects of kva. capacities, voltages, voltage taps, temperature rating, multiple connections, insulation tests, etc. On industrial control apparatus a set of symbols and diagrams has been approved. Terminal markings of all motors, generators, transformers and industrial control apparatus have been finally approved. Most of the work referred to has been under consideration for some time and portions of it previously approved.

SM Jr.

Save the Power of Our Unused Streams

By FRANKLIN K. LANE
Secretary of the Interior

WHEN Benjamin Franklin caught the lightning on the tail of his kite he did a lot of strange things for this world of which we are only beginning to learn. Among these are the uses to which flowing water may be put.

The old-fashioned waterwheel, which was the motive power of our early industries, is now converted into a turbine which generates electricity, and this has as great a variety of uses as the muscles of a man's arm or a horse's shoulder.

Among the other strange things done by Benjamin Franklin was to give an added and peculiar value to the ledges of granite which confine our Western streams and turn them into dam sites, useful for purposes of power generation.

FRANKLIN K. LANE

How many of these there are on public land not yet disposed of no one knows, but we have several hundred under withdrawal, and these should be freed from withdrawal and turned into use just as quickly as possible; for, as the muscle of man or horse can raise a few barrels of water from the well to supply stock or irrigate the garden patch, so can the power of the stream, turned into electricity, be used to raise millions of barrels of water to irrigate alfalfa farms or orchards. And this is now one of the most common uses of electric power in the West, and, in fact, in some of the Eastern States where irrigation is found of value.

The waters that flow down our streams are only a small portion of the rain and snow which fall.

There are streams that follow their courses underground just as clearly marked and as valuable, if once discovered, as the streams above ground. And to tap these is a part of making America. Cheap gasoline is doing it in some places; cheap coal in a very few; but cheaper electricity is doing it in a large way.

Then, too, there is that mystifying miracle of drawing nitrogen from the air for chemical use, which can be done only with great power, but is being done in Germany, Norway, Sweden, France, Switzerland and elsewhere, and by which an inexhaustible substitute for the almost exhausted nitrates of Chile has been found.

This is already a great industry in Europe, and will by necessity become greater in the United States than elsewhere, because of our size and need and opportunity.

To increase the yield of our farms and to give us an independent and adequate supply of nitrogen for the explosives used in war we must set waterwheels at work that will fix nitrogen in lime. And there are still more intimate uses for this power—in places in Montana it is so cheap that it operates the churn, the sewing machine and the vacuum cleaner, and supplies light to the house and fuel to the kitchen range. Indeed, for the possible uses of electricity there is no measure.

In order to put into use the potential power of our streams we must have legislation under which the withdrawn lands may be availed of and the power sites on our streams developed.

To Save Fuel Use the Central Station

A Statement by the United States Fuel Administration, prepared for the ELECTRICAL WORLD

FUEL saving through the conservation of electric power is one of the many important problems before the United States Fuel Administration. The order putting into effect two "lightless nights" a week has resulted in a substantial saving of coal—approximately 250,000 tons a year will be saved according to the best available figures.

In recent letters sent out by Fuel Administrator Garfield state administrators have been urged to obtain the cooperation of all electric public utility concerns in the elimination of all wasteful uses of electricity. Many of the state officials have reported that large savings have been effected already and that plans are under way for further conservation.

DR. H. A. GARFIELD

One of the most vital suggestions yet to come before the Fuel Administration has to do with the shutting down of the small isolated plants furnishing electrical energy. The largest and best managed electric light and power stations that are burning coal are using it with the greatest economy known in engineering practice. They have high-pressure boilers with ample heating surface, superheated steam, mechanical stokers, the most economical electric generators, steam turbines and high-vacuum condensers. They have water and steam meters, coal-weighing machines, pyrometers, carbon-dioxide indicators and recorders, and keep continuous records of their output and their coal consumption.

Considering the fluctuating demand for energy, it is not to be expected that by any changes of apparatus they can make any further important saving of coal.

The smaller stations and those that are not up to date in their equipment and methods of management can, however, make a great saving of coal by acquainting themselves with what is being done in the best plants and by copying them as far as possible. Hourly records of output and of coal consumption should be started, and premiums for coal saving should be given to the engineers and firemen.

The coal consumption in the large electric plants per kilowatt-hour is less than half of that of the average small plant of less than 500-kw. rating. Everything possible, therefore, should be done by the large stations to cause the voluntary closing of the small isolated plant.

The way to do this is to reduce the charges for power service as far as a reasonable return on the invested capital will permit. A general overhauling of prices charged for energy should be made, reducing the figures for power to encourage the abandonment of the small isolated plant, saving half the coal used by the latter, and recouping the loss of revenue by raising the figures for light, thus encouraging customers to be less wasteful in its use.

It is a recognized fact that there is an enormous waste of coal due to the extravagant and luxurious use of electric light.

[EDITOR'S NOTE.—In pointing to the economy of central-station service the Fuel Administration, of which Dr. Garfield is the head, is following its consistent policy.]

Manufacturers Aiding the Nation

Their War Machine for Freedom and Democracy Is a Connecting Link Between the National Forces and the Electrical Manufacturing Industry

BY ROBERT K. SHEPPARD

Representative of the Associated Manufacturers of Electrical Supplies on the General War Service Committee of the Electrical Manufacturing Industry

IT HAS been an old American adage that "time is money." To-day time is measured in lives, not money. Because our unit has changed, because time measures itself in the lives of the boys "over there" and yet to cross to France, it is clearly the duty of the electrical manufacturing industry to find the way in which time can best be used to give the aid that our nation must have if we are to win the war.

The electrical manufacturing industry is not alone in recognizing the critical nature of the emergency. A multitude of other industries have formed their war service committees.

The Advisory Commission of the Council of National Defense did a splendid, unselfish job. The preliminary work of that and other agencies and individuals is bearing fruit, and systematic mobilization of all industries is steadily progressing to a war basis. A sympathetic observer sees this when he visits Washington, and it gives courage to go forward with one's fellow manufacturers to build up machinery for helping the government with all of the facilities that we have.

The General War Service Committee of the Electrical Manufacturing Industry is to make a connecting link between the industry and the tremendous forces, now gaining headway in Washington, created to see that the national government gets what it needs. As a focus for the smaller committees representing groups of manufacturers the general committee will act to co-ordinate the different movements and make the composite result most effective.

As an example of the kind of work that is to be done by group committees, we have the results accomplished by the wire and cable group. What it is doing illustrates the kind of co-operation that we ask from each of the group committees of the industry. The basis of success of the wire and cable group is the unswerving loyalty of the manufacturers behind the group. They have said to their group committee: "You are the commander, we are here to obey." It is that kind of co-operation that we must provide back of the group committees and, therefore, back of the general committee.

It Is a Patriotic Job

The committees are sure to be effective. This is a war emergency. The job is something that is patriotic, that will provide the channels through which each can expedite the total productiveness of business much more rapidly than any other known method.

Some manufacturers have found as the war has developed—more will find as time passes—that there is a change in the sources from which business is obtained. Mill conditions which were regarded as balanced are no longer so adjusted, because the demand is supernormal for some products but has become sub-normal for others. George N. Peek has been placed in charge of the industrial division of the War Industries Board in Washington, so that working through the various war service committees of American industries he may systematize the conversion of facilities which are idle to-day or would be idle next month or next summer and make them of value for the business of war.

We who are serving on the general committee—and I feel that I may speak also for the members of all of the committees—are conscious that we are doing this work because the business of war requires that it be done, not because we individually think that it ought to be done. It is done because the manufacturers agree that it ought to be done. They believe that it is the right and best way to work out for the government the problems that touch production in our plants.

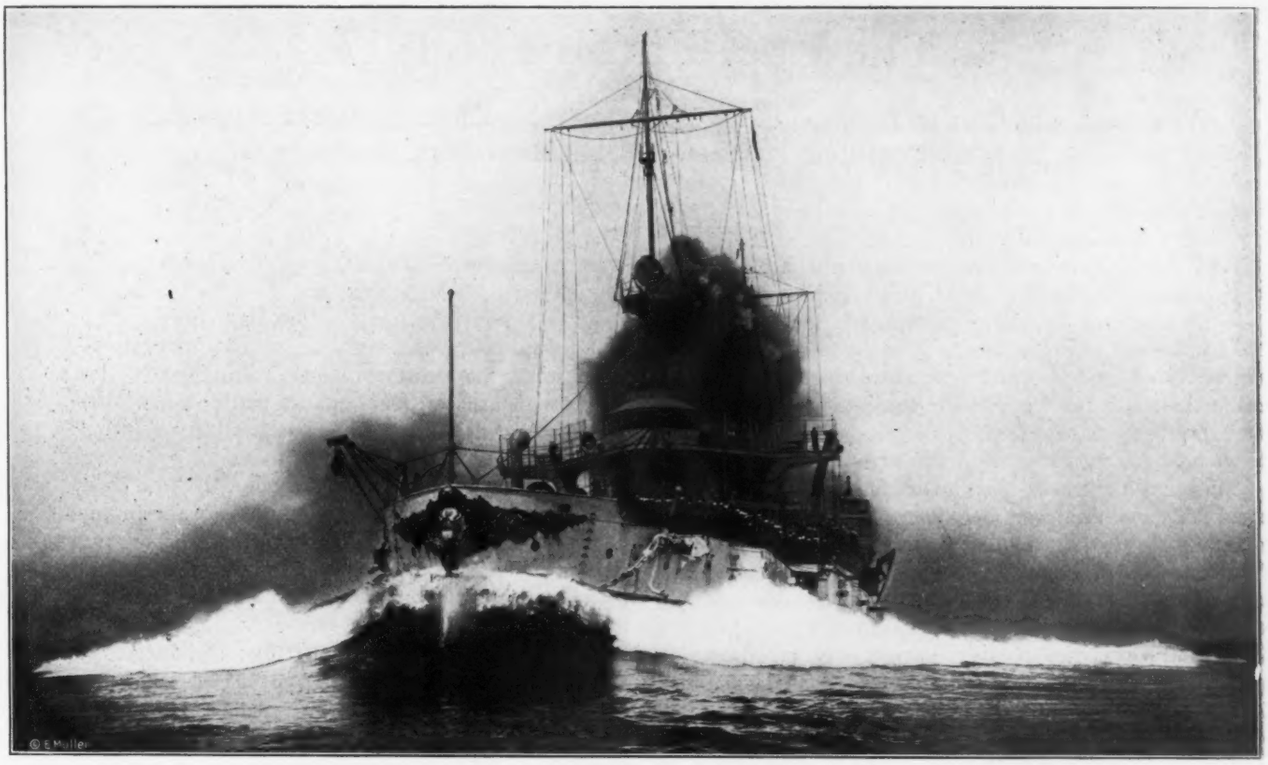
The general committee represents the industry. The group committees represent the divisions of the industry. This is not in any sense an association matter alone, because the entire industry, and not merely the association, wants to serve the nation. It is a big patriotic effort that we are making. It is costing men something to do it, and it is going to cost every manufacturer something to do his part, but it is something that will help to save our country. That is the demand, that is the aim. Production to meet the government needs is the first consideration. If the man outside of the association can produce twice as much as the man inside, give that man the business.

Classify the Business

There are four classes of business which the industry will have to consider carefully from this time forward: First, the direct government business; second, the indirect government business; third, the essential but non-government business; fourth, the non-government and not-essential-to-the-war business. I would not call the last "non-essential business" because it helps to keep factories in operation and it means a return on our capital and taxes for the government.

These four groups should be considered searchingly when a manufacturer thinks of the way in which his plant ought to be producing. If the plant is capable of production for the government directly, it is a patriotic duty to be doing it; if it is capable of production for the government indirectly, it is a patriotic duty to be doing it; if it is capable of production for the essential but non-government business, it is a matter of just as much loyalty to be doing that and the non-essential-for-war business ought to be considered last.

It is the first two of these classes of business that mean direct payment of money by the government, the circulation of the vast sums which are being raised for the war. The third and fourth are in large measure the sources of supply of the money with which we must pay our taxes to the government. A certain amount of taxes will be levied because of our profits on government business, direct and indirect; but I have full faith



THE RAPIDLY GROWING NAVY CALLS FOR GREAT QUANTITIES OF ELECTRICAL SUPPLIES

that the great body of electrical manufacturers could not feel that they were doing right if they profiteered. Therefore, the business that is directly or indirectly for the government and the business that is essential but non-government will be done at a minimum and reasonable profit, not because the government says it should be so, but because patriotism tells the manufacturer to do it that way.

It is right that the burden of the war should be distributed, that every concern, large or small, should do its share. It is for the interest of all and for the individual interest of each one that every manufacturer in the industry shall take his share of the load.

Suppose that a manufacturer needs a million parts of a certain product because of a pressing demand from the navy. Under ordinary conditions he would know where he could get the parts. But if these parts had to be produced in say twenty working days, any one producer would be swamped. So the manufacturer would apply to the appropriate group committee of the makers of those parts. That committee would arrange with individual manufacturers to take the orders, one 50,000, one 100,000, one 200,000, etc.

Another illustration of what committees may do is mirrored in to-day's labor situation. A serious shortage may be found in one community. The manufacturer tells his group committee of his difficulty, the group committee communicates with the General War Service Committee of the Electrical Manufacturing Industry, which in turn has access to the labor division of the War Industries Board. The secretary of the general committee will consult with other group committees of the industry. The problem will be solved by finding a district in which for essential industries there is a surplus of labor and diverting that labor to the districts where shortage exists.

Another problem may have to do with the question of factory quarters. A manufacturer may be threatened by unforeseen conditions affecting the lease of his plant and does not know how to meet them. He has a certain amount of government business and knows that it is essential to the war. He feels that the problem is not big enough to interest the authorities in Washington. Under these circumstances he goes to his group committee and his group committee to the general committee. The matter is taken up with Mr. Peek, director of the industrial division of the War Industries Board. The difficulties over the lease are arranged, or a new location is found, or the problem is solved at once in some other way.

It was only a few days ago that LeRoy Clark, chairman of the wire and cable group, had a call from a man who was doing government business. The caller had tried by the usual purchasing methods to get a large amount of wire but had been unable to do it. He said: "I cannot find it. What am I going to do about it?"

Mr. Clark replied: "You get authority from some one in Washington for this group committee to negotiate with you and we will see what we can do."

The caller got the authority and the subsequent conversation was something like this: "This article in the schedule we will supply to you next week; this one in four days; this one in seven days; this one in ten days."

The entire requirement, which that man could not find in the country, was ready for delivery to him in two weeks.

These illustrations make plain the usefulness of the committee organization, the war machine which the electrical manufacturers are creating and backing, to help retain for the children of this generation and all time to come the freedom which we received as a sacred heritage from our fathers.

The Fuel Famine of 1917

With Sufficient Cars at Disposal of Coal Operators No Shortage Would Have Existed—More Coal than Necessary Would Have Been Available

BY J. D. A. MORROW
General Secretary National Coal Association

THE year just closed has witnessed one of the most remarkable conditions in the bituminous coal industry ever known in the United States. The nation has been short of coal. Possessing the greatest resources of coal in the world, with abundant labor to mine this coal and with ample equipment at the mines to bring it to the surface, the country has nevertheless been held for weeks past in the grip of a fuel famine.

There need not have been a fuel famine in 1917; there need not have been even a coal shortage. That there was a famine, with its attendant suffering, was due solely to inadequate transportation facilities. Let us look for a moment at the facts. Bituminous coal mines of the country produced in 1917 approximately 540,000,000 tons. This was the greatest output ever recorded. It exceeded the output of 1916 by nearly 40,000,000 tons; it topped the yield of 1915 by nearly 100,000,000 tons.

Great as the output of 1917 was, it could have been greater. There is coal enough in the United States, it has been estimated, to supply the world for thousands of years at the present rate of consumption. There was labor enough in 1917 to bring this coal to the surface in volume far greater than it was brought to the surface. The mines could have met every need of the nation from the standpoint of labor and equipment if they had been permitted to operate to full production.

Plainly, therefore, inasmuch as the nation's needs were not met, something was wrong. It could not have been that there was not enough coal in the ground; the government figures show that there was, taking a general average, sufficient labor during the year to run the mines to a much larger production, and the equipment at the mines was ample to produce much more coal than was actually produced. What then was the trouble? The answer can be told in one word—transportation.

The coal was there, the labor was there, the equipment was there—but the railroad cars were not.

At least 75,000,000 tons of coal—probably 100,000,000 tons—could have been mined in 1917 that still remains in the ground for lack of adequate transportation facilities. The production of 1917 could have been in excess of 600,000,000 tons had the mines been permitted by the railroads to produce as much as they were capable of producing.

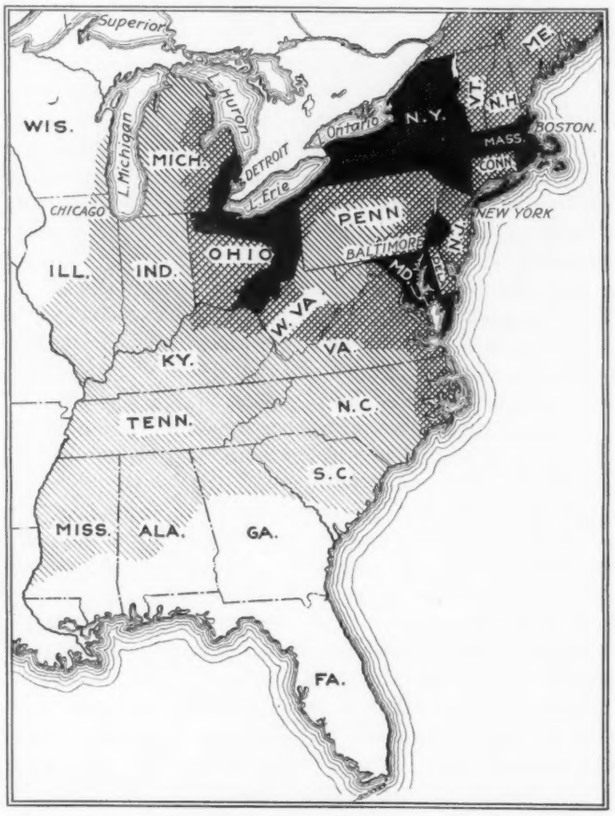
The authority of the United States government lies behind that assertion. Reports of the United States Geological Survey, gathered from every coal-producing section of the country, show that week after week lost production has mounted into millions of tons because there were insufficient cars at the mines to transport the coal as fast as it could be produced.

The week ended Dec. 15, 1917—the latest for which the Geological Survey returns are available—witnessed such a car shortage at the mines. The lost production of bituminous coal—and I am citing government figures—because of insufficient car supply in that week alone totals nearly 4,500,000 tons. The week before that it exceeded 3,000,000 tons; the week before that more than 2,000,000 tons; the week before that nearly 3,000,000 tons; the week before that more than 2,000,000 tons. Thus the story goes—day after day, week after week, month after month, all during the year.

The shortage was particularly acute in some sections. In Ohio, for instance. Ohio has coal mines—enough to supply the entire State and furnish an overflow to its neighbors—yet Ohio shivered during the first cold snap.

At the moment the people of Ohio were in the grip of the fuel famine the Ohio mines were running only part time because of the lack of cars. Here is a report from one field alone in Ohio for four days of one week in which Ohio suffered most.

On Monday mines that could have produced 722 carloads of coal received only 242 cars. On Tuesday mines that could have produced 966 carloads of coal received only 270 cars. On Wednesday mines that could have produced 998 carloads of coal received only 366 cars. On Thursday mines that could have produced 1158 carloads of coal received only 320 cars. And in that same week car shortage and congestion in the Pittsburgh field caused a loss of approximately 500,000 tons in bituminous coal production.



SECTION OF UNITED STATES WHERE COAL SHORTAGE WAS MOST ACUTE

While the Ohio and Pittsburgh mines were thus crippled the West Virginia mines were in a similar plight. Here is the lost production at 120 mines in the important Fairmont-Clarksburg section during that week: Monday, 15,000 tons; Tuesday, 33,600 tons, fifty-five mines idle all day; Wednesday, 33,700 tons, forty-nine mines idle all day; Thursday, 30,800 tons, thirty-eight mines idle all day; Friday, 40,000 tons, seventy-four mines idle all day; Saturday, 36,000 tons, forty-seven mines idle.

These illustrations are by no means abnormal. They are selected, it is true, to cover conditions during the week of the first cold snap of winter in the Middle West, because they bring home at that time as at no other the tremendous wastage in production.

It is only fair to add that during this week the railroads were crippled themselves by weather conditions. But the general situation that prevailed at the mines then had been prevailing for some time previously, and until the government took over the operation of the railroads continued to prevail in many sections.

So far as car supply in its effect on operations of mines is concerned the mine operators feel encouraged by the centralized control of the railroads under Mr. McAdoo. They feel satisfied that sufficient cars will be supplied to keep the mines running regularly somewhere near capacity. If this is done, the producers can keep their men, because the wages now paid are the highest in the history of the industry, and compare favorably with those paid in other lines of industry.

Coal producers expect the production in 1918 to set another new high record. They understand that the war needs of the country will require even more coal than has been produced in 1917. They are entering upon 1918 determined to produce the tonnage required.

Great Progress in Electrical Activity

Statistical Records of Large Growth in the Business of Different Branches of the Electrical Industry in the Year of Entry Into the War

BY T. C. MARTIN
Secretary National Electric Light Association

ALL else that happened in 1917 is subordinated to the vital, comprehensive fact that the year witnessed the entry of the United States into the great war. How we stayed out so long will ever remain a mystery unless we explain, but not excuse, it on the ground of moral and mental unpreparedness. The period from 1914 to 1917, during which we were too proud to fight, was given up to the unprecedented accumulation of wealth; but the lesson was only learned with slow reluctance that national obligations and international duties would require now the expenditure in warfare of all that had been accumulated while Europe was bled white of every resource. The effect of the tremendous change in American feeling and action is seen more distinctly every day in the conditions of society and of industry. Unexpected revolutions are in full swing whose results will go on indefinitely after the war has stopped.

In electrical development several novel phenomena are already noted, while others begin to cast anticipatory shadows of obscure outline. No one predicted or could foresee at the beginning of 1917 what has come to pass in any branch of electricity by way of expansion or restriction. One curious feature of the times is that a tendency has been manifested to limit the use of electrical service just when the stern injunction to economize is heard throughout the land. Saving to win the war is logical, but restriction of electricity is not, since its every successful application is predicated upon some saving in time, effort, money, as against the preceding method. In fact, in its struggle to redeem and use the wasted water powers, the central station utility is at this juncture the leading exponent, after Mr. Vanderlip, of the doctrines of true economy.

INCREASE IN CENTRAL STATION OUTPUT

Any estimate of the electrical figures of 1917 is attended with more than the ordinary elements of doubt, but as usual there are certain bases upon which calculations can be made. Thus it was assumed last January, in an article like this, that from earnings alone the central station income for 1916 had been $425,000,000. Data available about the same time put the amount at $417,000,000. This was larger than the 1915 total by more than 15 per cent. With some 3000 stations engaged in steam heating, ice making, the handling of supplies and other business, a large addition would be made, justifying the assumption that the total reached for 1916 of $500,000,000 must be a fairly close approximation. A 10 per cent increase on this for 1917 would bring the figure up to $550,000,000. The increases taken month by month would seem to justify this, especially as the gain in many months was quite considerable. Thus the increase for about 60 per cent of the industry in September, the latest month for which data are to hand at the time of writing, showed an advance over 1916 of 13.8 per cent in income and 13 per cent in output.

There is no reason to believe that output has fallen off, for many plants have been crowded far beyond their total generating capacity. Isolated plants have cried aloud to be hooked up. Industrial plants have begged in vain for a fuller allowance of energy from the circuits. The shortage of coal and the dimming of signs have come too late in the year to cause any marked present diminution in output, whatever may be the results in the next year of such conditions intensified. The long period of rate reductions would appear to have been closed; at least, rate increases have of late been more numerous. The year's net, however, may have been kept down by high costs.. But the spirit and principle of economy have also been in active demonstration. Let us then assume, on the whole, for the central station industry an income of $550,000,000. It must be remembered that, whatever may be the influences to the contrary, the uses of electric light and of

electric power multiply so fast that all accentuated economies and higher efficiencies are offset or absorbed.

Electric Railway Increase

In 1916 the total income of the whole electric railway field was estimated at $750,000,000. The rate of increase in street railways has not been very high of recent years, and many individual cases have been quite depressing; but the industry in the main has exhibited both staying power and recuperation. Moreover, the increase of travel with that of population goes on, and the larger employment of labor has been a marked cause in various localities of street-car crowding. This has occurred in spite, or because, of very low increase in new track or new cars. On urban lines the increase in gross has been noteworthy despite local strikes, and numerous increases in rates of fare have had their effect. A very large increase is to be noted on electrically equipped suburban sections of trunk roads and in the operation of electrified portions of such steam roads. Of course, the higher rates of wages and material have kept down the net, but the gross has certainly been 5 per cent higher and may even be 7 per cent or 8 per cent. It is fair to put the total for 1917 at $800,000,000.

Increase in Telephone Earnings

The extent to which the conditions of the times affect electrical utilities is strikingly shown in the fact that while for the period of eight months the American (Bell) Telephone & Telegraph Company's earnings rose from $171,608,490 to not less than $194,337,712, the operating net income was but $47,439,392, as compared with $47,586,666. The whole gain of nearly $23,000,000 was thus negatived with $150,000 more thrown in; but the gain was there all the same, and in due time the larger interest charges due to rapid increases of capital will work out to advantage. On the basis of total operating revenues of the Bell system of $270,000,000, the past year would show at 10 per cent increase an amount well in excess of $290,000,000. For telephony as a whole, including the independent systems, a total of, say, $425,000,000 might be set down. This may be high, but probably not far out of the way. There has been a tremendous use of the telephone throughout the year.

Telegraphy Keeps Pace with Other Services

What applies to telephony as a convenience turned to necessity applies equally to telegraphy, and it is therefore not surprising that the time-honored key and sounder have quite largely come into their own again, while both cable and wireless have been worked to the limit in spite of all censorship. For the telegraph 1917 has been a year not less fat than 1916, and so long as the war goes on the prospects for an extra dividend or two each year are quite rosy. Should the last quarter of 1917 equal in gains the preceding nine months, the Western Union system will undoubtedly be able to point to the best year in its history. The gross for ten months was not less than $63,471,538, as compared with $50,508,030. If to the gross earnings of the two great telegraph systems, including their land and cable lines, be added the wireless proceeds and the earnings of fire-alarm, burglar, police and kindred systems, a total of $175,000,000 seems likely.

Just what to set down for isolated plants remains as much of a problem as ever. Many such plants have been taken over by central stations, and the argument is more than ever that way in days of fuel famine and large water-power transmission; but doubtless the service of many isolated plants has been unduly heavy, even if it does not reach $200,000,000 all told, as estimated once in these pages. The sum of $150,000,000 is submitted as possibly near the mark.

Costs Affect Manufacturing Total

All estimates as to electrical manufacturing partake of the nature of guesses and as compared with the data of other years are just now of a peculiarly limited value. As was pointed out last year, the enormous advances in prices for raw material have "queered" any real comparisons. It is indeed remarkable that quotations for electrical supplies and apparatus have not gone much higher in view of exaggerated production costs and the active demand. There have naturally been notable advances in many articles, but as in the case of our swollen export trade the higher prices of raw materials are a partial explanation. On the other hand, there must be some economic reduction or saving due to larger production and the adoption of methods militating more keenly against waste. The total for the year may easily be up to $600,000,000. The latest government figures are about $360,000,000 for 1914, before all the startling jumps in raw material, wages, etc., took place, and the average increase of 10 per cent annually of the term 1909 to 1914 would in itself bring the total up to around $475,000,000. This, however, would not include several groups of electrical supplies in wood, glass, porcelain, etc. Hence the estimated $600,000,000 is not out of the way. The process of calculation is somewhat complicated also by the fact that many electrical manufacturers are in the munition business. Such figures as are obtainable are impressive. Thus the General Electric Company in connection with its latest necessary financing for more plants has stated its orders for 1917 at the striking amount of $240,000,000.

The miscellaneous group of electrical industries and utilities was placed in 1916 at $125,000,000. No reasons exist for believing the amount to have been any smaller in 1917. Summing up, therefore, the subjoined table may be presented for what it is worth.

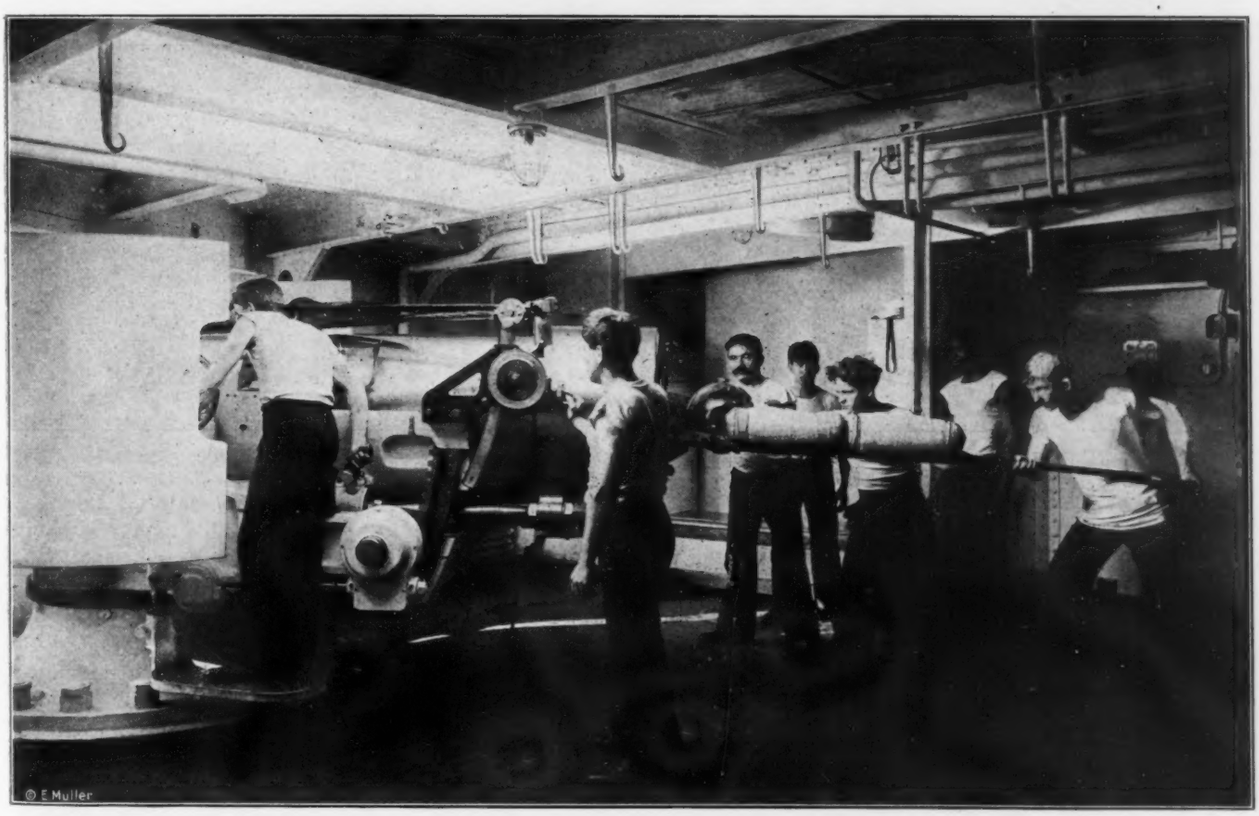
ELECTRICITY IN UNITED STATES, 1917

Central stations	$550,000,000
Electric traction	800,000,000
Telephony	425,000,000
Telegraphy	175,000,000
Isolated plants	150,000,000
Electrical manufacturing	600,000,000
Miscellaneous	125,000,000
Total	$2,825,000,000

This is $200,000,000 more than was submitted as an estimate for 1916, or in the vicinity of a 10 per cent increase, which was estimated also as the rate of increase in all recent years, as authorized by the United States Census returns. Such a total is impressive even in these times when billions have sadly lost their significance. It is believed that there is abundant justification for assuming the individual items and the grand total to be reasonably near the reality and as affording a basis of study or prophecy as to the coming curves of 1918.

Electricity Aids Navy in the War

Motors Are Used for Ammunition Hoists, Gun Carriages and Turrets and for Coaling Ships at Sea, Making the Fighting Units Highly Effective



Electrical Interconnection to Conserve Fuel

States of New York and California Present Evidence That Extensive Interconnection of Generating Systems Will Give Immediate and Practical Results in Fuel Conservation

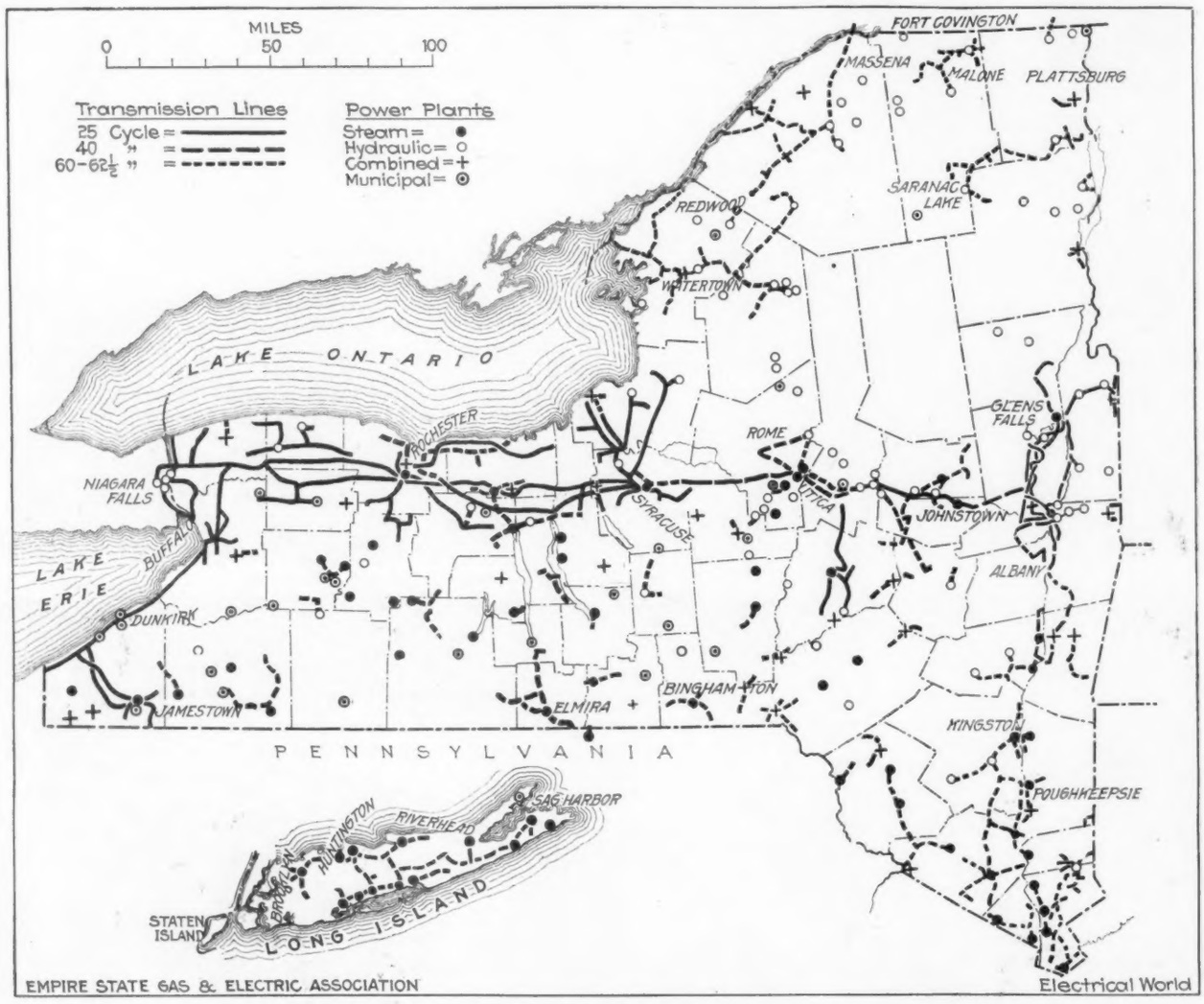
THE opportunity for extensive interconnection of generating systems as a means of conserving power and fuel has been given particular attention in the States of New York and California. As a war measure of first importance this subject is receiving consideration from both the utilities and the state regulating commissions. Offering the advantages of economy in fuel and generating facilities, together with better service to the public, the comprehensive arrangements which are under discussion are evidently forerunners of new policies affecting central stations.

The Empire State Gas and Electric Association, through its committee on war measures, composed of C. A. Graves, chairman, H. W. Peck and F. H. Hill, has taken steps to demonstrate the great value of such interconnection. This committee has made a report which includes a reference to the specific benefits of connecting plants. The association has also, as stated in the ELECTRICAL WORLD of Dec. 29, 1917, page 1260, presented the possibilities of the situation to the New York Public Service Commission, Second District.

A map prepared in the office of Charles H. B. Chapin, secretary of the association, is printed on this page.

The committee in its report shows that construction of transmission lines from efficient large plants to small village plants would make a material saving in coal. Transmission lines would enable many companies which are finding it difficult to obtain additional apparatus for handling increasing load to operate at full capacity because a breakdown or the withdrawal of one unit at one plant would be cared for by distribution of the load among other plants.

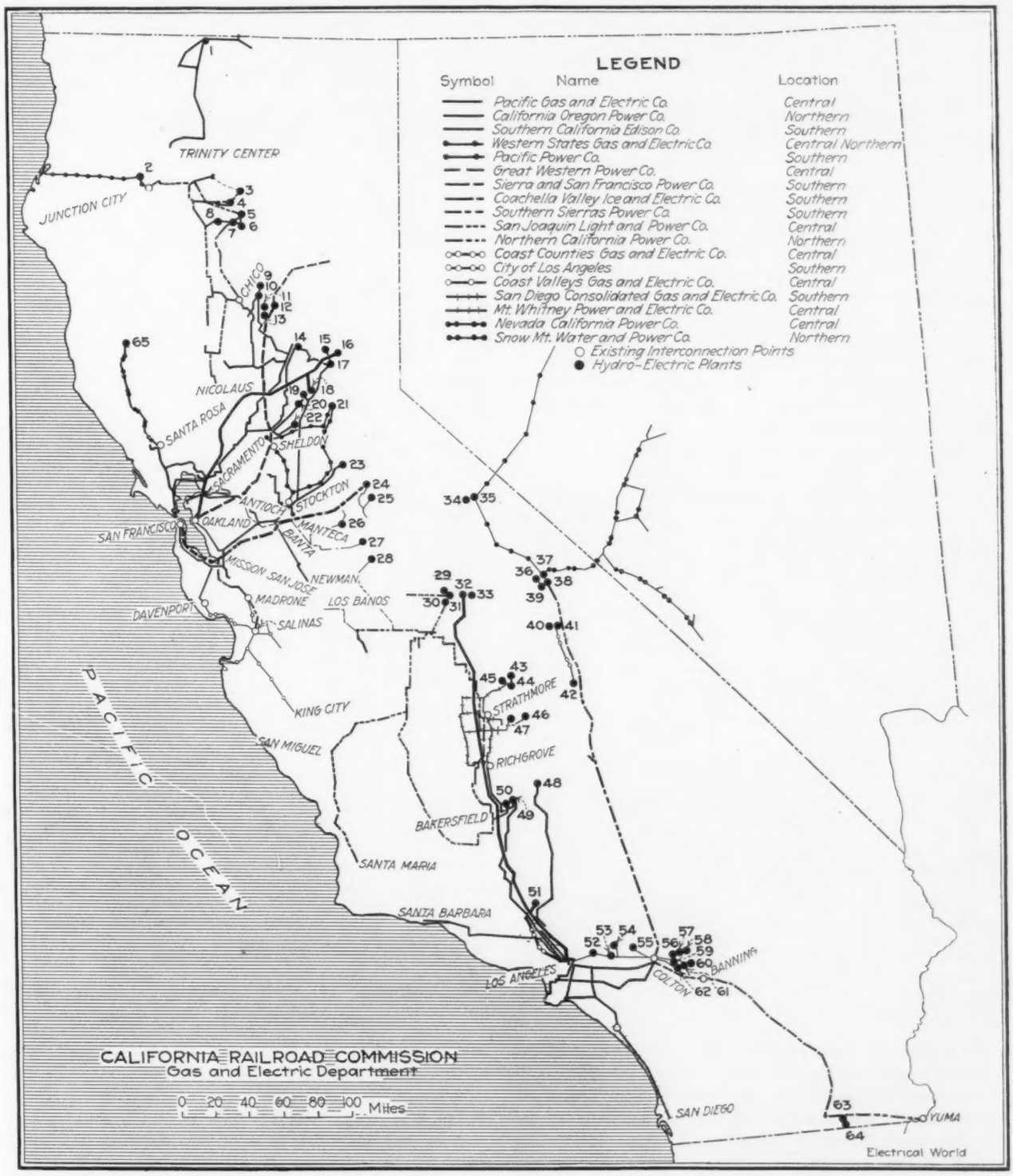
With its letter to the Public Service Commission, discussing ways of economizing fuel, the executive committee of the association sent a memorandum in regard to the interconnection of systems. This said in part:



EXISTING TRANSMISSION LINES IN NEW YORK STATE, SHOWING POSSIBILITIES OF FURTHER INTERCONNECTION

It is suggested that the most immediate and practicable results that may be accomplished in fuel conservation by public utility companies on a broad scale throughout the land can be attained by use of "linking up the companies"; that is, by interconnection and the tying in by transmission tie lines, etc., of adjoining systems. This has been accomplished on a considerable scale under war-time pressure in Great Britain and has also been developed to a considerable scale in the United States under the economic pressure above referred to. In different parts of the country large systems have been developed from huge central production sources, enabling mass production under the most economical conditions, this consolidation of production enabling the smaller and less efficient plants to be shut down wholly or during part of the time. These large central production sources have enabled them to deliver energy to the smaller and less efficient plants under conditions which have largely displaced their own power generation.

This general scheme of linking up accomplishes many purposes in economical power production, making it possible for the centralized plant to avail itself of the diversity factor that exists among a number of smaller and differently situated units. It enables the smaller units to be shut down during the whole summer season when the central



THE INTERCONNECTED TRANSMISSION SYSTEMS OF CALIFORNIA WHICH IT IS NOW PROPOSED TO WELD INTO ONE COMPLETE NETWORK COVERING THE ENTIRE STATE AND REACHING EVERY IMPORTANT CITY

generating plant has a considerable margin of capacity, and even during so-called peak periods it enables the smaller and less efficient plants to confine their operations to the peak hours, when it is necessary to have their installed capacity as a contribution to the total power necessary to handle the load of the consolidated system. Such linking up can often be accomplished by short tie connection or, where necessary, by transmission lines with reasonable expedition and with no great cost.

It is quite practicable to secure immediate results in many cases and enable fuel to be conserved, and such expenditures as may be involved become a permanent investment contributory to the permanent economic advantage that will be derived therefrom to the public as well as to the utilities interested. It is believed that such interconnection of utilities is of more immediate and practical advantage in fuel conservation than any attempt to secure greater operating efficiency in the individual plants.

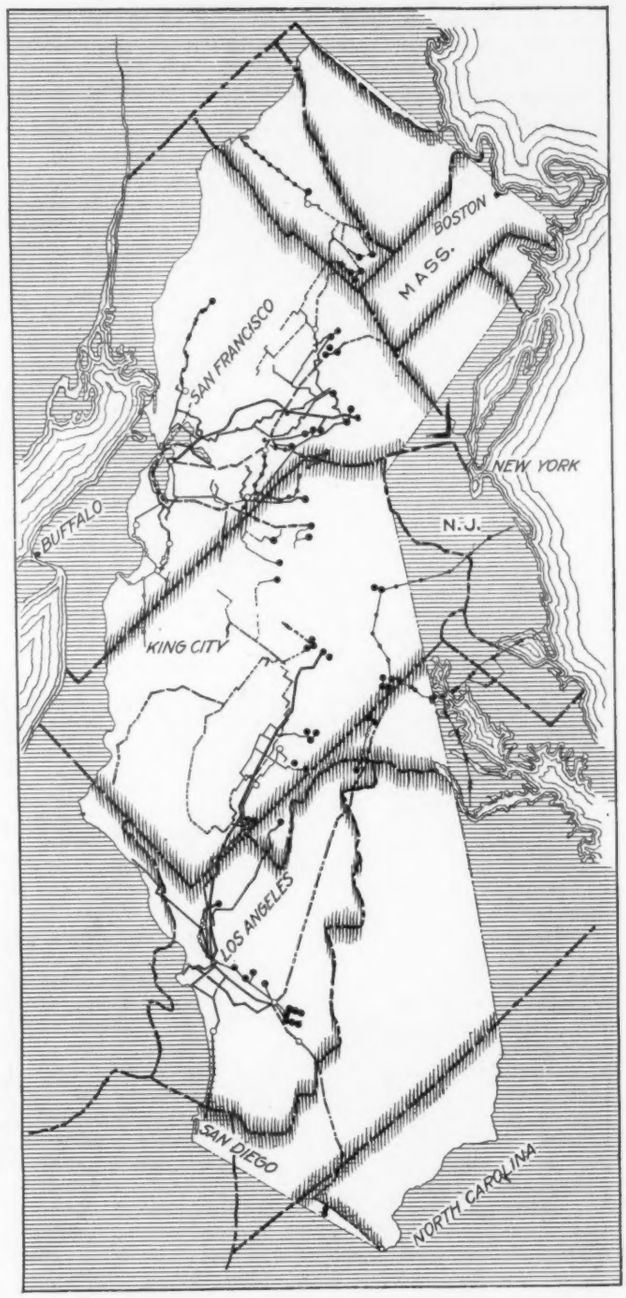
The Railroad Commission of California has been conducting a detailed study of the benefits that could be gained by certain interconnections of the primary transmission lines of the State. The investigations, under the immediate direction of F. Emerson Hoar, have been planned so as to show, among other things, just how much fuel oil could be saved in stand-by plants, how the combined load factor of the companies involved could be improved by certain tie-ins and how these tie-ins could be best accomplished. The results of this study have not yet been made public, but the map which was prepared at considerable expense to facilitate the work has been released and a special tracing made therefrom for use in the ELECTRICAL WORLD is reproduced on page 13.

The systems shown on the map last year handled 437,730 kw. developed by hydroelectric energy and 323,317 kw. developed by steam, a total of 761,047 kw. The interconnections now in use or under construction on Jan. 1 are shown in the map by circles. Attention is directed toward six interesting connection possibilities, as follows:

1. A 16-mile (25.7-km.) line from Kennett, on the Northern California Power Company's system, to tie in with the California Oregon Power Company's line at Minorsville.
2. An interconnection at Nicolaus between intersecting lines of the Pacific Gas & Electric Company and the Great Western Power Company.
3. A 15-mile (24.1-km.) line from Manteca, on the Sierra & San Francisco Power Company's system, to a junction with the Pacific Gas & Electric Company's line at Stockton.
4. A 35-mile (56.3-km.) line from King City, on the Coast Valleys Gas & Electric Company's system, to the San Joaquin Light & Power Corporation's line at San Miguel.
5. A 50-mile (80.4-km.) line from Santa Maria, on the San Joaquin Light & Power Corporation's system, to Santa Barbara, on the Southern California Edison Company's system.
6. A trunk-line connection between the central California group of lines that center around the San Francisco Bay region and the Southern California group, which could be reached near Fresno. This latter connection would require a link about 150 miles (241 km.) long, and while it will be a very desirable connection ultimately, it is not receiving serious consideration at present.

It is interesting to note that about 75 per cent of the energy generated for the central group of systems is utilized within 25 miles (40 km.) of San Francisco. The highest transmission voltage in California is the 150,000-volt, 240-mile (386.2-km.) line from Big Creek to Los Angeles.

All of the important lines in the State are operated at a frequency of 60 cycles except those of the Southern California Edison Company and the city of Los Angeles system. Frequency changers are being put in where the Southern California Edison line ties in with the San Diego Consolidated Gas & Electric. The Southern Sierras system, it will be noted, has a continuous series of lines of 17,000 volts or more extending for a distance of 450 miles (724.2 km.) north and south. Voltages lower than 17,000 are used on some of this company's lines in the southern part of its territory, and if these were taken into account the total distance of transmission would be much greater. In fact, energy generated in a latitude north of San Francisco on this system is delivered wholesale at the Mexican border for still further transmission to consumers south of that line.



THE INTERCONNECTED TRANSMISSION LINES OF CALIFORNIA WOULD STRETCH FROM MAINE TO NORTH CAROLINA, COVERING ELEVEN ATLANTIC STATES

Pacific Coast Companies Meet War Problems

Experiences of the California Utilities Under Present Critical Conditions Direct Forceful Attention to Necessity for Full Utilization of Water Power

BY JOHN A. BRITTON

Vice-President and General Manager Pacific Gas & Electric Company, San Francisco

THE situation on the Pacific Coast presents unusual conditions regarding the fuel necessary for the generation of power either for transportation or direct power purposes in that, with the exception of a few coal fields on the northern part of the coast between Oregon and Washington in the Puget Sound country, this section is dependent entirely upon oil.

The withdrawal of large portions of government lands from production a few years ago and the increased demand for oil for industrial and transportation uses have made the Pacific Coast feel more than any other section of the country its situation of dependence on this fuel. While it has developed a greater proportion of hydroelectric power than any other section of the country, due primarily to the very cheap power sold by the developing companies, it has not been able in its development to keep pace with the demands, and the power companies have been driven of late to a very much greater use of steam by means of fuel oil for the generation of energy to fill in the gap between demand and their full quota of hydroelectric power.

The initial hydroelectric plants on the coast were not built with the view of conserving the water, very few of them being provided with sufficient storage capacity. This is because the rivers in California offered in normal flow sufficient power at the time of first development. We are now beginning to feel the stress in the southern part of the Pacific Coast States of the dry season, which accounts for the large proportion of steam power now being used. Whereas in southern California in normal years but 8 per cent of the total output of electric energy was generated by means of steam plants, during the low-water period this year this generation has exceeded 30 per cent.

Fuel oil has increased abnormally in price. From the prevailing rate less than two years ago of 60 cents per barrel for fuel oil in San Francisco the cost has increased to $1.35 per barrel, and very little, if any, can be bought even at the now quoted figure of $1.55 per barrel. Storage of oil is decreasing monthly to the extent of about 1,000,000 barrels, and with no more than 14,000,000 barrels in storage available for fuel purposes it can be seen readily that the situation on the Pacific

IRRIGATION, BRINGING FOOD TO WIN THE WAR, IS A GREAT PART OF THE CALIFORNIA LOAD

Coast is serious and demands on its face the further development of hydroelectric power.

So long as the government of the United States resorts to the method it has pursued in the past of placing such restrictive conditions upon occupancy of government lands, hydroelectric power cannot and will not be developed in California. Instead of imposing restrictions and conditions upon such development, the government should offer a bonus on the capital that is willing to make the investment, because of the greater aid and benefit that that capital will be to the resources

not only of tris State but indirectly of the entire United States. Revocable licenses and the imposition of high charges for the use of a limited quantity of government land, on which most of the hydroelectric power companies are located, do not make for stability of capital investment, but practically render it impossible to obtain capital.

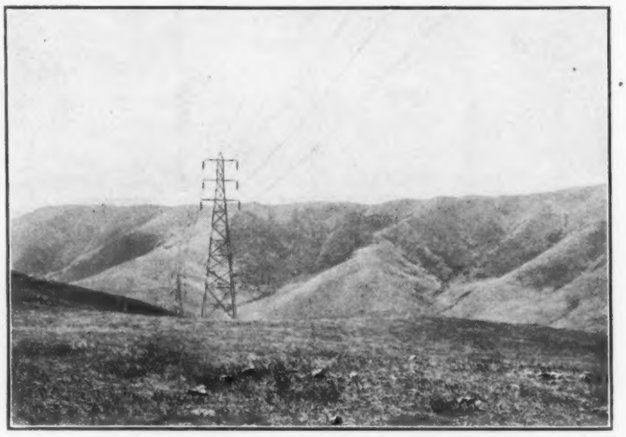
As all of the industries in California and all of the utilities and plants are built for the utilization of oil, it would be an almost impossible task to turn to any other fuel; in fact, no other fuel is available at present. Coal is not obtained in sufficient quantities on the coast to take the place of oil, and in these present times and for some time to come transportation of coal either by ships from Alaska and Australia or by rail from Oregon, Washington, Vancouver, or even the Colorado and Wyoming coal fields, is not to be conceived of. There is no electric plant on the coast that can be equipped to burn coal properly within at least three months. The diminution of our oil supply would, therefore, in view of these conditions, practically paralyze every industry on the coast.

I know of no stronger argument in favor of further hydroelectric development than the conservation of the natural resources which are exhaustible against other resources which are practically inexhaustible.

There is one particular satisfaction among the power men of the Pacific Coast, and that is that by reason of their ability in the earlier stages of hydroelectric development to sell power cheaply and by reason of the very low price at which fuel oil was sold, they were able to discourage the isolated power plant, which does not exist to any degree in California.

It is obvious that with the higher costs of operation due to increased cost and scarcity of labor and increased cost and scarcity of materials, higher rates must prevail than have prevailed heretofore. It seems an unfair proposition that producers of commodities, enabled by the exigencies of the situation to obtain more than ordinary profits, should be permitted to do so and let the utilities of the country bear the burden alone. Not only should utilities have better rates and a better return upon their uncertain investment, but they should be financed by consumers desiring long extensions and should have the aid of the Federal Reserve banks of this country in discounting utility paper.

Regulation by commission must be ineffective unless the commissions realize the necessity at times like these of proper protection of the investments committed to their charge. I am sure that the California commission fully realizes this situation and will give relief at the proper time and in the proper place.



TRANSMISSION LINES COVER GREAT AREAS

The outlook for the future prosperity of this State never was better. The war necessities have provoked a condition of economy so far as it is within the power of the times to create it, and utilization of products long since neglected and the development of industries heretofore unknown are bound to be constant factors even after the war has ceased, and personally I look for a period in the years to come of the greatest prosperity the coast has ever experienced.

War-Time Value of Hydroelectric Power

BY HENRY I. HARRIMAN
President New England Power Company and President Boston Chamber of Commerce

FOR more than a quarter of a century the engineers have recognized the value of hydroelectric power and have devoted the highest professional ability to its development. Banking and industrial interests have contributed funds and markets for this development; and public utilities, at first sometimes unaware of its economic importance, have entered into co-operative arrangements for the purchase and interchange of energy with large-scale producers and distributers of water power. The foundation for future development has been firmly established.

The present shortage of coal accentuates the value of hydroelectric power service in a most striking way. Vast resources remain undeveloped along the streams of our country, and it is unfortunate that under present war conditions the cost of utilizing waterfalls now running to waste is so great in many instances as to retard capital from service in this vitally important field. The passage of the Shields bill by the Senate is most encouraging, despite the fact that the bill is not wholly satisfactory from the standpoint of the power producer; and it is to be hoped that this bill, or one closely resembling it, will be passed by the House and receive the signature of the President soon. If this is done, the development of much needed power from navigable streams in particular will be facilitated.

Concretely, water power is mitigating hardships of the present fuel situation to an extent that probably is little realized. With a 50 per cent load factor, every kilowatt of installed capacity in a hydroelectric station saves the equivalent of about 5 tons of coal per year, allowing from 2 lb. to 2.5 lb. of coal per kilowatt-hour. The present rate of output of the New England Power Company's water-driven generators is saving central New England 300,000 tons of bituminous coal per annum. From two-thirds to three-fourths of the output of this system is now derived from waterfall. The market is practically sold out for hydroelectric energy in this territory.

While a curtailment of service averaging about one-sixth has been forced upon our industrial power customers by the shortage of coal in auxiliary plants, there is no question that these customers have suffered much less in this way than would have been the case had they been dependent upon their own fuel supplies. In general the curtailment of service has been received patriotically by customers.

During the year just closed it has been impossible to create the usual reserve stocks of coal in New England, and this section of the country received only about 80 per cent of its normal bituminous coal shipments. A heavy demand for power resulted from increased industrial activity due to the war. Users of hydroelectric service have been able to obtain it with regularity and on the basis of contracts placed when the price of coal ranged from $4.50 to $5 per ton. This has enabled power purchasers to take long views ahead in planning factory operations and expansion programs. The stability of water power when developed, barring the fluctuations of flowage in different streams, is a real asset, not only to a company producing and transmitting such energy for distribution, but to industrial organizations controlling such power within their own premises or at sites owned by them distant from their establishments. Complete exhaustion of water power in a system developed along modern engineering lines, with due regard for storage and for close control of outputs at different stations in a transmission network, is most unlikely.

The steam plant, on the other hand, is threatened by a complete tie-up if an adequate supply of fuel cannot be obtained. Three of the larger central stations operating in the New England Power Company's territory at present have only sufficient coal to carry them seventeen days; and by contrast it should be noted that no properly engineered large water-power system is likely to be completely down and out even under the most unfavorable conditions. There is good reason to expect more favorable water conditions before the winter ends; a week or two of mild weather will increase the run-off on the snow-covered and frozen watersheds of the upper Deerfield and Connecticut valleys to an extent that will be very helpful in the existing fuel scarcity, and vigorous efforts are being made to complete the installation of a 45,000-kw. turbo-generator at Providence, R. I., where steam power can be purchased to supplement the requirements of the transmission system of the New England company.

I have been asked whether it would be advisable for the federal government to undertake to finance water-power development in New England, at present deferred by high cost of money, labor and materials. Such a policy would certainly have endless ramifications; it would lead to many varied and scattered demands upon the public treasury from different sources interested in power production from streams, and the heavy calls upon the country for money with which to finance war needs must be met before funds can be spared for developments of the kind referred to.

The question is also affected by the uncertainty of duration of the war. Under favorable circumstances a hydroelectric development of magnitude requires about two years for completion, and in the light of present conditions the situation as regards power demand should be met by private capital rather than by public funds. Certainly until more evidence is forthcoming of the inability of privately owned utilities to solve the problems associated with the production, transmission and distribution of electrical energy for service under war conditions, I should be disinclined to favor governmental entry into this field, the hands of the public authorities being already fully occupied with the huge tasks of war on a scale unprecedented in the history of our country.

Engineering Societies' War Activities

A Survey and Analysis of the More Important Ways in Which National Technical Bodies Have Aided the Government

IN THE year just closed, almost nine months ago to the day, the United States, through President Wilson, formally declared itself at war with Germany. American citizens were prompt to offer their services to the nation, and in this eagerness to serve none were more quick or more prepared than the engineers of the United States.

Anticipating the possibility that this country might find it necessary to answer the insolence of the imperial German government with the sword, the engineering citizenship of the nation, through the national engineering societies, early in 1915, when the conflict in Europe was but a little more than half a year old, started on a concrete program of preparedness.

Since that time the nation's engineering talent through its national association affiliations has tremendously increased its government war-aid activities until at one time not many months ago it seemed for the moment to be defeating its very aims because too many activities often seriously overlapped and frequently conflicted. This crisis, however, is now believed to have passed, and the opinion seems to prevail that through the formation of the Engineering Council harmony of accomplishment will be completely restored and that co-ordinated effort will result.

It is therefore with a view toward showing broadly how those national engineering bodies with which the ELECTRICAL WORLD is more intimately connected have endeavored to serve the government that this analysis of the war activities by engineering societies has been undertaken.

FIRST STEP THREE YEARS AGO

The first step was made early in 1915, about two years before the United States actually became a participant in the war, in the formation of a joint committee of representatives from each of the national societies of electrical, mechanical, mining, civil and consulting engineers to co-operate with the War Department in the organization of a National Engineer Reserve. The direct result of this committee's work was the provision by Congress for an Engineer Officers' Reserve Corps, now in full operation, evidences of which are apparent in the great number of commissioned engineers. A tabulation of these in the higher ranks will be found elsewhere in this issue.

In the formation of this reserve the societies were of no small value. The American Institute of Electrical Engineers early sent out a brief military data sheet to its membership. More than 2000 of these filled-out sheets were forwarded to the Institute's representative at Washington, who was chairman of the Institute's committee on national defense, and were turned over by him to the various departments of the army and navy. From these sheets men were selected for their qualifications, and to them were sent application forms for admission to the Reserve Corps.

Besides, in order that the engineers might know exactly what were the requirements for the reserve, the five societies above mentioned distributed prior to the entrance of the United States into the war two pamphlets, one for the army, the other for the navy. These pamphlets were both based on government reports and orders. In this and many other ways the engineering bodies of the country have been particularly active in giving the widest publicity of the most helpful nature to the nation's requirements and needs in engineering details and personnel.

SECRETARY DANIELS' INVITATION

Following the steps taken to give the engineer a recognized place in national service, as above explained, came the invitation on July 19, 1915, from Secretary of the Navy Daniels to the engineering societies to select each two members for appointment by the Secretary of the Navy to act with Thomas A. Edison as chairman on an advisory committee to assist the Navy Department both instructively and critically in the development of new ideas for naval advance, thereby making available to the navy the best fruits of American inventiveness. Such was the formation of the Naval Consulting Board, the value of which needs here no further exposition.

The usefulness of this board has been greatly increased since its formation through the collection of data on the nation's manufacturing resources. To accomplish this work the engineering societies were again called upon, this time by President Wilson, each to nominate a representative in each state of the Union to act in conjunction with representatives of the other associations to assist in this work of industrial preparedness. A plan for a census and classification of manufacturing industry was put into effect, and by the time the United States had entered the war returns had been received from 27,000 of the larger plants.

The War Committee of Technical Societies, the formation of which was initiated by the Engineering Council, and which is acting in close co-operation with the Naval Consulting Board, has been doing a very valuable work. This committee is composed of two members from each of the national societies of civil, electrical, mechanical, mining, gas, electrochemical, illuminating, mining and metallurgical and refrigerating engineers. At the request of the ELECTRICAL WORLD, David W. Brunton, chairman of this committee, has prepared the following statement of the committee's aims and functions:

> The general attitude of the government of the United States toward inventors is that it is anxious to receive and consider any new inventions relating to war equipment and operations. To some extent there have been actual invitations to undertake such work.
>
> The technically trained men of the country, who are peculiarly fitted to undertake creative work, appear to be taking but little part in volunteer war invention. This is probably due to the fact that it is not the habit of such men to undertake inventive work until they know what is wanted and have the necessary information for it. With the exception of those technical men who have been able to enter the army and navy and a small percentage actually at work in the va-

rious boards, councils, committees, bureaus, etc., the technical men of the country are merely filling their usual positions in its industrial system. They are, however, in a state of increasing dissatisfaction with this situation. That in a war of science and machinery more than 100,000 trained men, eager and patriotic, should have no direct means of applying their specialized abilities as engineers, electricians and chemists in aid of the nation seems intolerable to them.

To meet this situation the War Committee of Technical Societies was organized. Its purpose is to bring war work to these 100,000 men at their own homes. It will, from every available source, collect those war problems of research and invention which will be useful and valuable to the government, formulate them properly with the aid of specialists, and distribute them to all the membership of the societies accompanied by the data desired so far as this is practicable.

In delivering the results of this organized general work to the government, it is planned to turn over each class of results to the particular agency which now handles that class for the government, such as the Naval Consulting Board, the National Research Council, the Aircraft Production Board, the Council of National Defense, etc. It is the intention to assist and support and strengthen in every way possible each of these existing agencies, and to distribute for them all problems which they desire to have presented to the general membership of the societies.

Recognizing the need for co-ordinating the resources and industries of the country, Congress on Aug. 29, 1916, authorized the formation of the Council of National Defense, which has since played a leading part in the government's war program. To assist the council in a consulting capacity, without pay, an advisory commission was authorized. A number of the national engineering societies were consequently invited to appoint representatives on the committee on science and research of the advisory commission to which the supervision of engineering matters had been assigned.

The following month, at the request of President Wilson, there was created by the National Academy of Sciences, the National Research Council to co ordinate existing scientific and research organizations and to encourage research in industry and war, to the end that the nation might be strengthened. The work of the Research Council is being carried on through the agency of central committees, including one on engineering. To this committee the national engineering associations were invited to appoint two members each to constitute with the engineer members of the Council the engineering committee. The Research Council through its various committees has been of unusual service to the government. Its members have been able to solve many problems for the different divisions of the army and navy, besides aiding in many instances American industry to turn out new products.

As strictly society functions, however, where the different bodies were working on their own initiative, the classification and cross-indexing of the membership of these societies is perhaps the most noteworthy. Each member has been mailed a questionnaire which, with the necessary exception of "experience" details, is virtually uniform for several of the societies. Some of the societies are doing this work alone, but a number have placed the indexing in the hands of the American Society of Mechanical Engineers, on whose original questionnaire the present general engineering questionnaire was based, each society, of course, paying the expense involved in its work.

Besides giving the customary personal data, the applicant can by a system of easily understood symbols specify exactly what his experience has been and what are his specialties. By means of a carefully designed system all of these answers are now being cross-indexed, so that at any time the government or industry should need a man or men with certain definite engineering qualifications the engineering societies will be in a position quickly to furnish a list of those best qualified. By this means the government and industry will have for the first time at its command information on specially qualified engineers. In many other ways, seemingly more concrete and apparent, have the engineering societies been able to serve the government.

ACTIVITIES OF THE A. I. E. E.

The American Institute of Electrical Engineers, for instance, has assisted the government in obtaining the services of technical men for the following branches of service: By request of the Bureau of Navigation the Institute nominated eighty-five graduate electrical engineers for appointment as lieutenants, junior grade, United States Naval Reserve Force; Bureau of Yards and Docks, candidates for appointment in the Civil Engineer Corps of the United States Naval Reserve Force, for the ranks of ensign, lieutenant, junior grade, and lieutenant; Bureau of Chemistry, electrical and mechanical engineers for special investigations throughout the country; Signal Corps, electrical men for the radio division and the aviation section; Bureau of Navigation, candidates for aviation inspection duty for training as ensigns in the Naval Reserve Flying Corps; Coast Artillery School, department of enlisted specialists, draftsmen, engineers, electricians and radio operators, as temporary non-commissioned officers, and in many other ways.

The American Society of Mechanical Engineers has done similar service in furnishing men in lots from one to a hundred or so for government and civilian service. It has assisted materially in the fuel administration through co-operation with the officers of the Bureau of Mines.

The Illuminating Engineering Society has had a similar experience and through its committee on war service has been able to be of considerable very evident service to the government in the design of lighting for buildings and grounds of aviation camps and for night flying, and also in the design of lighting for other buildings being erected by the Navy Department and the Department of War. This society at the request of Samuel Gompers nominated two members to serve with the committee of labor of the Council of National Defense to take up the question of factory, mill and workshop lighting, (1) to conserve eyesight of workmen, (2) to make factories safe by proper lighting, (3) by giving proper lighting to increase efficiency of workmen, and (4) to increase output and decrease spoilage. A code on lighting was prepared by the members designated by the society and accepted by the government. It has not yet been distributed, owing to the pressure of other work. Five states already have taken up the rules of the code and have either put them into practice or are under way to do so.

These results are by no means all that the engineering societies have accomplished, but they serve to show the effectiveness of such bodies and the valuable assistance that they can render to the government. Just at present plans are being perfected toward co-ordinating these activities under the Engineering Council which

was formed as the outgrowth of a real need for proper consideration of questions of general interest to engineers and to the public, and to provide the means for united action upon questions of common concern. At present the council is concerned only with the electrical, mechanical, civil and mining engineering national societies, but provision has been made for the election to membership of other national engineering and technical societies.

An insight into the co-ordinative principle of the council is gained from a paragraph or two from a recent announcement by the council:

Certain questions relate to the war and the assistance that engineers can render. A committee, to be called the American Engineering Service Committee, was appointed with instructions to invite the co-operation of all engineering societies in tabulating and listing the members of the five societies represented, in order that we as a profession may be in a position to take a larger part in the industries after peace is declared. This tabulation has already in part been done, but in a rather unsystematic and unequal way. It is hoped that the new committee by having additions from other societies may make a final and lasting tabulation of all the engineers in the United States. The list is to be kept in the Engineering Societies Building for use in government problems and in the industries. At present the committee is devoting its attention to the immediate need of the hour, namely, the procurement of men for special service in the government. A list of specialists in the societies has already been completed.

Another committee, of which David W. Brunton is chairman, is called the War Committee of Technical Societies. The members are Messrs. A. M. Greene, R. N. Inglis, C. R. Corning, G. C. Stone, D. W. Brunton, J. M. Boyle, J. V. Davies, Joseph Bijur, A. S. McAllister, W. D. Richardson and Charles Baskerville. It was appointed to assist any organization in Washington, such as, for instance, the Council of National Defense, the National Research Council and the Naval Consulting Board, in any way in which it can bring to the attention of the engineers of the country the necessity for thought and help in the numerous national problems that arise.

That the engineering bodies of the country have been performing a distinctly valuable war service to the nation is recognized by President Wilson and by the war administration of the government. That these bodies through co-operative and co-ordinated efforts will be an ever-increasing factor in the successful waging of the war is unquestioned.

American Engineers in Service

List of More than Three Hundred Electrical and Mechanical Engineers with Commissions of Captain or Higher

ENGINEERS were quick to place themselves in the active service of the country when war broke out. Already many thousands of them are serving in one capacity or another. To list all of these would be too great a task. As indicative, however, of the extent to which the profession is represented there follows a list of 336 engineers who have received the commission of captain or a higher rank in the army or the navy. These names were taken from the lists of the American Institute of Electrical Engineers and also from those of the American Society of Mechanical Engineers.

KEY TO ABBREVIATIONS

O. D.—Ordnance Department.
E. O. R. C.—Engineer Officers' Reserve Corps.
S. O. R. C.—Signal Officers' Reserve Corps.
C. A. O. R. C.—Coast Artillery Officers' Reserve Corps.
O. O. R. C.—Ordnance Officers' Reserve Corps.
U. S. R.—United States Reserve.
N. R. F.—Naval Reserve Force.
C. A. C.—Coast Artillery Corps.
S C.—Signal Corps.

A

ABADIE, EUGENE H.
Major U. S. R. Cantonment Division Hdqtrs, Consulting engineer, St. Louis, Mo.

ADAMS, WALTER H.
Capt., E. O. R. C., Prof. Mech. Engrg., Throop College of Tech., Pasadena, Calif.

ADAMSON, KEITH F.
Capt. Inf. U. S. R., Exp. Force.

ALLEN, WALTER C.
Major, Signal Corps Amer. Exped. Forces, France. Pres. Yale & Towne Mfg. Co., New York, N. Y.

ALLYN, ROBERT S.
Major, 9th Coast Defense Command C. A. C., National Army, New York. Member of firm Mitchell & Allyn, New York, N. Y.

AMES, AZELL.
Major N. Y. Coast Artillery. Kerite Ins. Wire & Cable Co., N. Y.

ARISON, E. E.
Major Prod. Sect. Gun Div. Ord. Dept. U. S. R. Vp. & Effic. Eng. The Emerson Co., Chic., Ill.

ARMSTRONG, HENRY C.
Capt., Ordnance Dept., U. S. R. Metallurgical Expt., U. S. Navy Dept., Pittsburgh, Pa.

ARNOLD, BION J.
Major O. R. C. Cons. Eng., Chic., Ill.

ARNOLD, HAROLD D.
Capt. S. O. R. C. Asst. Research Eng. Western El. Co., N. Y.

ARNOLD, HARRY S.
Capt. E. O. R. C. Construction Eng., United El. Constr. Co., N. Y.

ASHLEY, CARL.
Electric Bond & Share Co., New York City.

B

BABCOCK, A. H.
Maj. E. O. R. C. Cons. El. Eng. So. Pac. Co., San Francisco, Cal.

BAER, C. A.
Capt. E. O. R. C. Mill power specialist General El. Co., Philadelphia, Pa.

BAIRD, JAMES T., JR.
Capt. O. D., U. S. R. New Haven, Conn.

BALDWIN, BERT L.
Major E. O. R. C. (unassigned). Cons. Eng., Cincinnati, Ohio.

BARKER, HARRY.
Capt. E. O. R. C. Assoc. Editor Engineering News-Record, N. Y.

BARTON, PHILIP P.
Major E. O. R. C. V. P. & Gen. Mgr. Niagara Falls Power Co. and Gen. Mgr. Canadian Niagara Pr. Co.

BECK, VERNON S.
Capt. E. O. R. C. Pres. & Mgr. Beck Electrical Constr. Co., Minneapolis, Minn.

BEEBE, LAWRENCE L.
Capt. E. O. R. C. Asst. M. E. U. S. Dept. of Agri., Office of Public Roads & Rural Engrg., Washington, D. C.

BEHR, FRANCIS J.
Capt. C. A. C., Hammond Radio Research Lab., Gloucester, Mass.

BEHRENS, EDWARD L.
Capt. U. S. A.

BENEDICT, BRUCE W.
Capt., 1st Ill. Field Artillery, commanding Battery F. Div. Shop Labs., Dept. of M. E., Univ. of Ill., Urbana, Ill.

BENHAM, W. L.
Maj. Q. M. O. R. C., Camp Funston, Ft. Riley, Kan. The Benham Eng. Co., Oklahoma City, Okla.

BERLINER, RICHARD W.
Capt., E. O. R. C. Engr. of Wks., Engrg. Dept., American Optical Co., Charlton City, Mass.

BETTS, EUGENE.
Maj. Q. M. O. R. C. Gen. Mgr. Argentine Tramways & Pr. Co. Ltd.
BETTS, PHILANDER.
Maj. E. O. R. C. Chief Eng. N. J. State Pub. Utils Comm.
BILGER, HENRY E.
Capt., E. O. R. C. Supt. Tools & Gauges, The Baldwin Loco. Wks., Philadelphia, Pa.
BILLINGS, A. W. K.
Lieut. Comm. U. S. N. Aviation Forces.
BIRNIE, ROGERS.
Colonel, U. S. Army. New York City.
BLAIR, ED. J.
Capt., 311th Eng. El. Eng. Chic. Elev. R.R. Chic.
BLAKE, EDWIN T.
Capt., E. O. R. C. (unassig.) Vp. & Eng. Blake Bros. Co., San Fr., Cal.
BOARDMAN, ALBERT J.
Capt., Division Amer. Ordnance Base Depot in France, Washington. Supt. Terre Haute, Indianapolis & Eastern Traction Co., Indianapolis, Ind.
BOND, F. M.
Capt. Insp. of Ordnance. Industrial Eng. Philadelphia El. Co., Phila, Pa.
BOWLES, FRANK G.
Major, O. D., U. S. R., Inspection Div., Carriage Section.
BOYD, RICHARD L.
Capt. 325th Inf. Dist. Mgr. Southern Bell Tel. & Tel. Co., Jacksonville, Fla.
BRADFORD, J. S.
Capt. 103rd Engs., Co. B, Camp Hancock, Augusta, Ga. Insp. Eng. Dept. E. I. duPont de Nemours & Co., Wilmington, Del.
BRADY, GEORGE S.
Capt. Amer. Ord. Base Depot in France. Supvr. of Production, Winchester Repeating Arms Co., New Haven, Cann.
BRENNAN, JAMES.
Capt. & Aide-de-Camp, 7th Div., U. S. Army. Ch. Engr., Crucible Steel Co. of Amer., Pittsburgh, Pa.
BREWSTER, HENRY B.
Capt. 303rd Reg. Engs., Camp Dix, N. J. Engr. H. S. Kerbaugh, Inc., Rochester, N. Y.
BRIGGS, LEROY E.
Capt. O. O. R. C. M. E., Ordnance Dept., Hartford, Conn.
BRILL, G. M.
Maj. O. R. C. (unassigned). Cons. Engr., Poughquay, N. Y.
BROWN, FRED W.
Capt. O. O. R. C. Vp. Asso. Engrg. Co., Somerset, Ky.
BROOKS, HENRY N.
Capt. 308th Engs. Cons. Eng., Chic., Ill.
BROWN, ROSCOE.
Capt. Inf. Div. Hdqrtrs, Camp Meade. Distr. Sales Mgr. Electric Service Supplies Co., Pittsburgh, Pa.
BUCHANAN, J. L.
Capt. E. O. R. C. Asst. Dist. Mgr. Supply Dept. Genl. El. Co., Chic., Ill.
BUCK, RICHARD S.
Major 1st Engrs. Cons. Engr., New York City.
BUCKLEY, JOHN H.
Capt. Equipment Engr., Small Arms Div., Frankford Arsenal. Index Div. Engr. Otis Elevator Co., Yonkers, N. Y.
BURNHAM, WM. A.
Capt. E. O. R. C. Asst. Supt. Shops & Equipment, Chicago Elev Railroads.
BURROUGHS, JOSEPH H., JR.
Capt. C. A. C., Fort Du Pont, Del. Baldwin Loco. Wks., Philadelphia, Pa.
BUSH, HAROLD M.
Colonel, 134th Field Artillery, 37th Div., U. S. Army. Camp Sherman, Ala. Cons. Engr., Columbus & Briggsdale, O.
BUTTERS, J. H.
Capt. 6th District, Australia. Chief Engr. & Mgr. Hydroel. Dept., Govt. of Tasmania, Australia.
BYLLESBY, H. M.
Maj. U. S. R. Signal Corps Hdqrtrs. Pres. H. M. Byllesby & Co., Chic., Ill.

C

CALDWELL, E. W.
Capt. Med. O. R. C. M. D. Specialist in X-Ray, N. Y.
CAMPBELL, EDMUND D.
Capt., O. O. R. C., Sea Coast Section, Carriage Div., Washington, D. C.
CAMPBELL, JEREMIAH.
Major Engrs., U. S. R. C., Amer. Exped. Forces, France. Ipswich, Mass.
CATTY, J. J.
Col. Signal Corps. Chief Engr., American Tel. & Tel. Co., N. Y.
CASE, MILO M.
Capt., E. O. R. C. M. E., Chicago, Ill.
CASSIDY, PERRY.
Capt. A. O. R. C. Asst. Prof., Thermodynamics, Univ. of Ky., Lexington, Ky.
CATTELL, WILLIAM A.
Major, E. O. R. C. Cons. Engr., San Francisco, Cal.
CHAMBERLAIN, PAUL M.
Major, O. O. R. C. Cons. Engr., Chicago, Ill.
CHANDLER, C. DE F.
Col. Signal Corps, Balloon Div. (Regular).
CHAPIN, WARREN W.
Capt. Engr., U. S. R. Asst. Str. Eng., Carrere & Hastings, N. Y.
CHILDS, R. B.
Capt. Inf. N. A. Comml. Agt. Great Falls (Mont.) Pr. Co.
CHURCH, ELIHU C.
Capt. E. O. R. C., Adjutant 117th Engr. Regiment, 42nd Div. Cons. Engr., New York City.
CLEMONS, ROBERT S.
Major, Commanding 506th Engrg. Service Bureau, Camp Lee, Va. Mem. of Firm R. S. Clemons & Co., Philadelphia, Pa.
CLOKEY, A. A.
Capt. S. O. R. C. Engr. Dept., Western Union Tel. Co., N. Y.
CLUETT, SANFORD L.
Major, S. C., N. Y. National Guard. First V. P., Secy., Walter A Wood Mowing & Reaping Machine Co., Hoosick Falls, N. Y.
COHO, H. B.
Capt. Q. M. O. R. C. Asst. Sec., United Lead Co., N. Y.
COLE, C. S.
Capt. Ord. Res. Sec.-Treas., Columbia Steel Co., Pittsburg, Cal.
CONANT, WM. S.
Capt. O. O. R. C. Cons. Engr., Detroit, Mich.
COOPER, HUGH.
Lieut. Col. N. A. Cons. Engr., New York City.
COUSINS, V. D.
Capt. C. A. O. R. C. Telephone Engr., San Fr., Cal.
CRAFT, E. B.
Capt. S. O. R. C. Development Engr., Western El. Co., N. Y.
CRAMER, L. B.
Capt. E. O. R. C. El. Engr., Oakland, Cal.
CROCKER, JAMES R.
Capt. E. O. R. C., 106th Pioneers. Chief Engr., Permutit Co., N. Y.
CRAWFORD, CHAUNCEY H.
Capt., 302nd Engrs., Camp Upton, Yaphank, L. I. Asst. Engr., Mech. Dept., Nashville, Chattanooga & St. Louis Ry., Nashville, Tenn.
CUDEBEC, A. B.
Electric Bond & Share Co., New York City.
CUNTZ, JOHN H.
Capt. S. O. R. C. Cons. Engr., Hoboken, N. J.

D

DAILEY, FRED. A.
Capt., E. O. R. C. Pres., Treas., Union Machine Co., St. Paul, Minn.
DAMON, JOHN C.
Capt. E. O. R. C. El. Engr., Utah Pow. & Lt. Co., Salt Lake City, Utah.
DE LEMOS, SIDNEY P.
Capt., 317th Engrs., National Army. Bureau of Pub. Bldgs. & Offices, New York City.
DE VISSER, JOHN H.
Capt., O. O. R. C., Supply Div. Sales Engr., The Coon-De Visser Co., Detroit, Mich.
DICKERSON, H. S.
Capt. U. S. R. Prof. Mech., Eng. & Pract. Mech., Sch. of Mines, Univ. of Mo., Rolla, Mo.
DIEMER, HUGO.
Major, O. S., U. S. R. Prof. Industrial Engrg., Pa. State College, and Cons. Industrial Engr., State College, Pa.
DONALDSON, J. M.
Capt., 16th King's Royal Rifles. Chief Asst. Engr., North Metrop. El. Pr. Supply Co., Croydon, Eng.
DOTY, PAUL.
Major, E. O. R. C. V. P., Gen. Mgr., St. Paul Gas Light Co., St. Paul, Minn.
DUFFY, FRANK J
Major, 103rd Engr. Charge of El. Work in D. L. & W. Mining Dept.
DUNCAN, T. C.
Capt., Q. M. C., U. S. R.

E

EATON, BERNARD L.
Capt., O. O. R. C. Erecting Engr., I. P. Morris Co.
ELLISON, LOUIS H.
Capt., E. O. R. C. Western El. Co., Chic., Ill.
ELMES, CLYDE C.
Capt., E. O. R. C. Asst. Supt., Eddystone Ammunition Corp., Eddystone, Pa.
ENNIS, WILLIAM S.
Major, O. O. R. C. Prof. M. E., Poly. Inst. of Brooklyn, Brooklyn, N. Y.
ESTABROOK, M.
Capt., Ord. Dept. Niles-Bement-Pond Co., N. Y.
EVANS, LOUIS M.
Capt., S. O. R. C. Chief Engr. Signal Corps. (Regular).

F

FAIRLEY, G. E. A.
Capt., E. O. R. C. Asst. Chief Engr., Electrical Commission, City of Baltimore., Md.
FALKENAU, ROBT. M.
Capt., Q. M. U. S. R, U. S. Exped. Force, New Rochelle, N. Y.
FARLEY, JAMES JOSEPH
Capt., O. O. R. C. Asst. Engr., Interboro Rapid Transit Co., N. Y.
FARRINGTON, THOMAS H.
Capt., E. O. R. C. M. E., McMahon, Farrington & Baker, Oswego, N. Y.
FELKER, GEORGE F.
Capt., O. S., U. S. R., Camp Wheeler, Macon, Ga.
FESSENDEN, C. H.
Capt., O. O. R. C., Frankford Ars. Asst. Prof. Mech. Eng., Univ. of Mich., Ann Arbor, Mich.
FIELD, FREDERICK C.
Capt., O. O. R. C., Small Arms Div. Engr., Midvale Steel & Ordnance Co., Nicetown, Pa.
FINNEY, T. H.
Major, E. O. R. C., 105th Engrs., Aluminum Co. of Amer.
FISHLEIGH, WALTER T.
Major, Sanitary Corps, N. A. Surgeon Gen'l's Office, Wash.
FITZGERALD, EDWARD T.
Capt., 2d Battalion, Naval Militia, New York. Ry. Engr., Pub. Serv. Comm., First Dist., New York City.
FORDYCE, JOHN R.
Major, Engrs., U. S. R. Cons. & Constr. Engr., Little Rock, Ark.
FRANKLIN, BENJ. A.
Major, Ord. Dept. V. P., Swathmore Paper Co., Mittineague, Mass.
FRY, ALFRED B.
Capt., U. S. National Naval Volunteers. Ch. Engr., U. S. T. Serv., N. Y. City.
FULLER, RAY W.
Capt., Co. A., Engrs., U. S. & Pa. E. E., Scranton, Pa.
FULLERTON, I. P.
Major, S. O. R. C. Gen'l Supt. of Plant, Pacific Tel. & Tel. Co., San Fr., Cal.

G

GARDNER, F. Q. C.
Capt., N. Y. Coast Artill., in charge of Torpedo Dept. (Regular).
GAUSS, W. F.
Capt., S. O. R. C., U. S. Exp. Force. Supervisor of Methods, Central District Tel. Co., Pittsburgh, Pa.
GILBERT, HUNTLY H.
Capt., O. O. R. C., Field Artillery Section, Washington, D. C.
GILBRETH, FRANK B.
Major, E. O. R. C., O. D. Pres., Frank B. Gilbreth, N. Y. City.
GILLIS, H. A.
Major, E. O. R. C. M. E., Washington, D. C.
GORHAM, H. B. L.
Capt., E. O. R. C. El. Engr., Northwestern Ordnance Co., Madison, Wis.
GOTSHALL, WM. C.
Major, Engr. Corps. Cons. R. R. Engr., N. Y.
GRAY, G. FRANCIS.
Capt., O. O. R. C. (unassig.). Industrial Research Specialist, Melone Inst., Pittsburgh, Pa.
GREEN, C. W.
Capt., C. A. O. R. C. Asst. Prof. El. Eng., Mass. Inst. of Tech., Cambridge, Mass.
GREEN, FREDERICK W.
Capt., Co. A., 12th Engrs., Amer. Exp. Forces in France. Asst. to Pres., St. Louis, Southwestern Ry. Co., St. Louis, Mo.
GREENE, AUGUSTINE E.
Major, O. O. R. C. Supt. Pwr. Dept., Winchester Repeating Arms Co., New Haven, Conn.
GREENLEAF, GEORGE E.
Major, Ord. Bureau, U. S. Army. M. E., Niles-Bement-Pond Co., Plainfield, N. J.
GREGORY, WILLIAM B.
Major, E. O. R. C., Amer. Exp. Forces in France. Prof. Exper. Engrg., Tulane University; Irrigation Engr., U. S. Dept. of Agri., New Orleans, La.
GRISWOLD, A. H.
Major, 8th Telegr., Signal Reserve Corps. Plant Engr., Pacific Tel. & Tel. Co., San Fr., Cal.
GROWDON, JAMES P.
Capt., E. O. R. C., 4th Engrs. Engr. Dept., Northwestern El. Co., Portland, Ore.
GUIST, W. E.
Capt., O. O. R. C. Eff. Engr., The Amer. Tool Wks. Co., Cincinnati, O.
GUISE, HIRAM B.
Major, O. O. R. C. (unassig.). Works Engr., Rubber Regenerating Co., Mishawaka, Ind.
GUITERAS, JULIAN G.
Capt., 4th Engrs., Co. B., U. S. Army, Vancouver Barracks, Wash. M. E., N. Y. City.

GUNBY, FRANK M.
Major, Cantonment Div., Quartermaster Corps, U. S. R. E. E., Chas. T. Mains Cons. Engr., Boston, Mass.
GUTHRIE, JAMES.
Major, O. O. R. C., U. S. Army, Washington, D. C.

H

HALE, HENRY H., JR.
Capt., E. O. R. C. Cons. Mech. Engr., Boston, Mass.
HALL, HARRIS F.
Capt., Co. M, 6th Inf. Ill., Nat. Army, Chicago Heights, Ill.
HALL, KEPPELE.
Capt., Ord. Dept., U. S. R., Supply Div. Cons. Engr., Assoc. with Sanford E. Thompson, Newton Highlands, Mass.
HALL, QUINCY H.
Capt., E. O. R. C. Inspg. & Testing Engr., St. Paul, Minn.
HARISBERGER, JOHN.
Capt., E. O. R. C. Gen'l Supt. Light Pr. Dept., Puget Sound Traction Lt. & Pr. Co., Seattle, Wash.
HARRIES, GEORGE H.
Brig. Genl., 59th Depot Brigade. V. P., H. M. Bellesby Co., Chic., Ill.
HAYNES, A. R.
Capt., E. O. R. C., 316th Engrs. Chief Oper., White Riv. Gen. Stat., Puget Sound Tr., Lt. & Pr. Co., Dieringer, Wash.
HAYS, JOHN C.
Major, Q. M., U. S. R. Cons. Engr., San Fr., Cal.
HAZELHURST, JAMES N.
Major, E. O. R. C., Atlanta, Ga.
HEINZE, CARL A.
Capt., E. O. R. C. Asst. El. Engr., Bureau of Pr. & Lt., City of Los Angeles, Cal.
HERBERT, J. S.
Capt., E. O. R. C., Johnstown, Pa.
HERRCKE, E. A.
Capt., O. O. R. C. Supt. La Salle Mach. & Tool Co., La Salle, Ill.
HEWITT, RICHARD B.
Capt., Engr. Dept., Ft. Sam Houston, Tex.
HILES, ELMER K.
Capt., 5th Reg., E. O. R. C. Mech. Engr., Pittsburgh, Pa.
HILL, E. LOGAN.
Capt., E. O. R. C. Mgr. El. Lines, Erie R. R., N. Y.
HILL, M. W.
Capt., E. O. R. C, Cons. & Contr. Engr., Baltimore, Md.
HIRSCH, GUSTAV.
Major, S. O. R. C. Cons. Engr., Columbus, Ohio.
HODGES, W. L.
Major, N. Y. Guard. Eastern Rep. Industrial Works, N. Y. C.
HOLCOMBE, AMAS M.
Capt., Ord. Dept., Small Arms Div., U. S. R. Pat. Atty. with Carr & Carr, St. Louis, Mo.
HOLMAN, R. CLAUDE.
Capt., I. O. M. O. C., 53rd Ordnance, Mobile, Workshop (Light) British Exp. Forces, France.
HOLMES, URBAN T.
Commander U. S. N., Navy Dept., Cramp's Shipyard, Phila.
HORNER, L. S.
Major, Singal Corrs. V. P., Acme Wire Co., New Haven, Conn.
HUBBELL, LYMAN P.
Capt., Q. M. C., 74th N. Y. Inf., N. A. Pres., Fillmore Ave. Foundry & Iron Wks., Buffalo, N. Y.
HUBER, C. J.
Capt., O. O. R. C. Cons. Engr., Buffalo, N. Y.
HUNT, H. B.
Major, Ord. Dept., Gun Div. Engr., Sales Dept., Am. Loco. Co., N. Y.
HUNT, LEIGH.
Major, 110th Engrs., Camp Doniphan, Okla. Pres., Hunt Engr. Co., Kansas City, Mo.
HUTCHENS, EDWARD.
Capt., E. O. R. C. Supervising Engr., Federal Rubber Co., Cudahy, Wis.

I

IRELAND, MARK L.
Capt., Q. M. C., Ft. Houston, Tex.

J

JACKSON, JOHN R.
Capt., O. O. R. C. Asst. Engr. Tests, A. T. & S. F. Ry. System, Chic., Ill.
JACKSON, JOHN P.
Major, E. O. R. C. Pennsylvania Commissioner of Labor and Industry, Harrisburg, Pa.
JAMIESON, CHAS. C.
Major, Cannon Sect., Gun Div., Ord. Dept., Wash., D. C. Jamieson and Houston, N. Y.
JENKS, GLEN F.
Major, Ord. Dept., U. S. A., Ithaca, N. Y.
JEWETT, F. B.
Major, S. O. R. C. Asst. Chief Engr., Western El. Co., N. Y.
JOHNSON, CHAS. F.
Capt., 319th Inf. Engr. Dept., Virginia Ry. & Pr. Co., Richmond, Va.
JONES, REID.
Capt., E. O. R. C. Thomas & Jones, San Antonio, Tex.
JONES, REGINALD L.
Capt., S. O. R. C. Transmission Engr., Western El. Co., N. Y.
JUNKERSFELD, P.
Major, E. O. R. C., Super. Constr., Quartermaster Cantonment Div. Asst. to V. P., Commonwealth Edison Co., Chic., Ill.
JURGENSEN, J. C.
Major, Ord. Dept. Gen'l Supt., Mech. Depts., United Piece Dye Wks., Lodi, N. J.

K

KAELIN, CHAS. G.
Capt., O. O. R. C., Rock Isl. Arsenal.
KATTE, EDWIN B.
Major, E. O. R. C. (Unassig.). Chief Engr. Electric Traction, N. Y. Cent. R. R., Grand Central Terminal, N. Y.
KEELER, N. B.
Capt., E. O. R. C. El. Engr. in Regular Army.
KEENAN, EDWARD T.
Capt., Engr. Corps. El. Engr., Northern Ore Co., Edwards, N. Y.
KEEP, HENRY.
Major, E. O. R. C. Supt. Constr., Thompson-Starrett Co., N. Y.
KELLY, JOSEPH T., JR.
Capt., E. O. R. C., 305th Engr. Asst. Supt. of Distrib., Consolidated Gas, El. Lt. & Pr. Co., Baltimore, Md.
KEPLINGER, WM. L.
Capt., E. O. R. C. Special Engr., Higrade Petroleum & Gasoline Co., Phila., Pa.
KILGOUR, HAMILTON.
Division Officer Royal Engrs. Cons. Egr., East Orange, N. J.
KILPATRICK, JOHN D.
Major, N. J. N. A. Cons. Hyd. Engr., N. Y.
KNERR, LEWIS E.
Capt., E. O. R. C., Kansas City, Mo.
KNOWLTON, FREDERICK K.
Capt., O. O. R. C. Pres., M. D. Knowlton Co., Rochester, N. Y.
KRATZ, A. B.
Major, Engr. U. S. R. Mech. Div., Panama Canal, Balboa, C. Z.
KREIGSMAN, A. E.
Capt., E. O. R. C., 308th Engrs. Engr., Dept. Pub. Service Co. of Northern Ill., Chic., Ill.
KUNZE, EDWARD J.
Capt., Q. M., U. S. R., Ft. Riley, Kan.

L

LACOMBE, CHAS. F.
Capt., 25th Engrs. Cons. Engr., N. Y.
LAMONT, CLARENCE B.
Capt., E. O. R. C. Cons. Engr., Seattle, Wash.
LANCASTER, WM. C.
Capt., E. O. R. C. (unassig.). El. Engr., Mount Royal Tunnel & Terminal Co., Montreal, Que.
LARSEN, CHAS.
Capt., 26th Engrs., Camp Dix, N. J.
LEA, EDWARD S.
Major, Frankford Arsenal. Cons. Engr., Trenton, N. J.
LEE, CLAUDIUS.
Capt., O. O. R. C. Prof. El. Engr., Virginia Polytech. Inst., Blacksburg, Va.
LENT, LEON B.
Capt., Aviation Sect. Sig. Corp., active duty Curtis Aeroplane Co., Buffalo, N. Y. Pres., Lent Motor Fire Eng. Corp., N. Y.
LINCOLN, PAUL M.
Capt., E. O. R. C. Commercial Engr., Ry. & Ltg. Dept., Westinghouse El. & Mfg. Co., Pittsburgh, Pa.
LIPSNER, BENJ. B.
Capt., Ord. Dept. Motor Sect., U. S. A., Chicago, Ill.
LONGLEY, FRANCIS B.
Major, Engr. Dept., Sig. Corps Aviation School, San Diego, Cal.
LONGSTRETH, CHAS.
Lieut. Comm., U. S. N. R., Phila., Pa.
LOELL, A. A.
Major, 310th Engrs. Assoc. Prof., El. Eng., Univ. of Mich., Ann Arbor, Mich.
LYMAN, ELIHU R.
Capt., Ord. Dept., U. S. R., Camp Doniphan, Ft. Sill, Okla.
LYON, PERCY S.
Capt., Coast Art. Res., Ft. Monroe, Va.
LYON, R. R.
Capt., Coast Artillery (Regular).
LYSTER, T. L. B.
Major, Signal Corps. Chief Engr., Hooker Electro Chem. Co., Niagara Falls, N. Y.

M

McGEACHIN, WM. R.
Capt., E. O. R. C.
McGLONE, R. G.
Capt., 23rd Engrs., Camp Meade, Md. Mech. Engr., U. S. Eng. Depts., U. S. Eng. Office, Galveston, Tex.
McGRATH, M. K.
Major, S. O. R. C., U. S. Exp. Force. Western El. Co., N. Y.
McGREW, J. A.
Major, Q. M. R. C. Asst. Gen'l Supt. Transp., The Del. & Hud. Co., Albany, N. Y.
McIVER, G. W., JR.
Capt., E. O. R. C. Wisconsin-Minnesota Lt. & Pr. Co., Eau Claire, Wis.
McMUNN, WM. N.
Commander, Ill. Nav. Res., Chic., Ill.
MACOMBER, ALEXANDER.
Capt., E. O. R. C. El. Engr., Chas. H. Tenny & Co., Boston, Mass.
MANSFIELD, JULIAN B.
Capt., Inf. and Art. Res. Chief Engr., V. P. & G. M., The J. E. Bolles Iron & Wire Wks., Detroit, Mich.
MANSON, G. K.
Major, S. O. R. C. Chief Engr., New Eng. Tel. & Tel. Co., Boston, Mass.
MARKHAM, CARL W.
Capt., E. O. R. C. El. Engr. Office, Panama Canal.
MARSHALL, WM. C.
Capt., Ord. Dept., U. S. R. Mech. Engr., The Holt Mfg. Co., Peoria, Ill.
MARTIN, KINGSLEY G.
Capt., Motor Truck Co. 57. Amer. Steel Export Co., N. Y.
MARTINDALE, E. H.
Capt., E. O. R. C. Pres. & G. M., Hardy Supply Co., Cleveland, Ohio.
MAXFIELD, HOWARD H.
Capt. E. O. R. C., Supt. Motive Power, Pennsylvania R. R., Pittsburgh, Pa.
MAXWELL, ALEXANDER.
Capt. E. O. R. C., Chief of Lab., N. Y. Edison Co.
MAXWELL, J. M. S.
Capt. Royal Engr., Managing Director Electric Control, Ltd., Glasgow, Scotland.
MAY, OSCAR J
Capt. Eng. Div., U. S. A., Chief Engr. Chic. Distr. The Texas Co., Chic., Ill.
MAYER, EDWIN C.
Capt. C. A. O. R. C., Sales Engr. Commonwealth Edis. Co., Chic., Ill.
MERSHON, RALPH D.
Maj. E. O. R. C., Cons. Eng., N. Y.
METZ, WALTER B.
Capt. Q. M. C., U. S. R., Chicago, Ill.
MIDDLETON, NATHAN A.
Capt. E. O. R. C., Eng. in Charge Eng. Dept., Hornblower & Weeks, Boston, Mass.
MILLER, T. EDGAR.
Capt. E. O. R. C., U. S. Exp. Force, J. G. White, Eng Corps., N. Y.
MILLER, LORIMER D.
Capt. E. O. R. C., Gen'l Eng. Depot, Washington, D. C.
MIXTER, GEO. W.
Maj. Sig. Corps, Equip. Div., V. P. Deere & Co., Moline, Ill.
MONAGHAN, JAMES F.
Capt. O. O. R. C., Cons. Eng., Boston, Mass.
MOON, HARTLEY M.
Major Inf., 4th Bat, 3rd Reg., Mfg. Dept. Continental Gin Co., Birmingham, Ala.
MULOCK, REDFORD H.
Squadron Commander Royal Naval Air Service, Member Firm Mulock, Armstrong & Lindsay, Attorneys, Winnipeg, Canada.

N

NEWCOMB, ROBERT. S.
Capt. Coast Art. Corps, N. Y. N. A., Mech. Eng., Walker & Chambers, N. Y.
NEWHALL, WM. B.
Capt. E. O. R. C., Cons. Engr., Minneapolis, Minn.
NEWTON, GUY D.
Maj. E. O. R. C., Asst. Prof. Drawing & Descriptive Geometry, Univ. of Mo., Columbia, Mo.
NORRIS, EARLE B.
Capt. O. O. R. C., Field Art., Section Carriage Div.

O

OBERLIN, E. G.
Lieut. Com., U. S. N.
O'REILLY, THOS. W.
Capt. Medical O. R. C., M. D. Specialist in X-Ray, Los Angeles, Cal.
OWENS, ROBT. B.
Capt. S. O. R. C. Sec. Franklin Institute, Phila., Pa.

P

PANCOAST, FRED L.
Capt. Ord. Dept., U. S. R., Winchester Repeating Arms Co., New Haven, Conn.
PARKER, CHAS. H.
Capt. (retired) Mass. Naval Militia, Asst. Supt. Gener. Dept., Edis. El. Illg. Co. of Boston, Mass.
PARKS, BURRITT A.
Capt. E. O. R. C., Cons. Eng., Byron E. Parks & Son, Grand Rapids, Mich.
PEASE, MAURICE N.
Capt. 301st Engrs., Stanley Rule & Level Co., New Britain, Conn.
PEIRCE, A. E.
Capt. E. O. R. C., V. P. Wisconsin-Minnesota Light & Power Co., Eau Claire, Wis.
PELOT, JOSEPH H.
Maj. Ord. Dept., U. S. A., Frankford Arsenal, Phila., Pa.
PENGILLY, JOSEPH H.
Capt. E. O. R. C., Pr. Eng. Dept., So. California Edison Co., Los Angeles, Cal.
PENNEY, RUPERT L.
Capt. O. O. R. C., Supervisor Winchester Repeating Arms Co., New Haven, Conn.
PETERSON, C. A.
Capt. E. O. R. C., El. Eng., Treasury Dept., Washington, D. C.
POPE, FREDERICK.
Capt. 30th Engrs., Gas & Flame Div., Moses, Pope & Messer, N. Y.
PRESCOTT, R. D.
Capt. S. O. R. C., Inspector Gen'l Telegraph & Telephone, Rep. of Panama.

R

RANSOPHER, SILAS M.
Capt. 117th Field Batt. Signal Troops, 42nd Div., Principal, Lathrop School of Mechanical Trades, Kan. City, Mo.
RATHJENS, GEO. W.
Maj. 313th Engrs., Camp Dodge, Des Moines, Ia.
REPER, SAMUEL.
Col. Signal Corps, U. S. A. (Regular.)
REED, E. HOWARD.
Lieut. Comm. Torpedo Sta., Newport, R. I., Pres. Reed Small Tool Wks., Worcester, Mass.
REHFIELD, GROVER G.
Capt. Ft. Leavenworth, Kan., El. Eng., Chicago Portland Cement Co., Chic., Ill.
REIMER, A. A.
Maj. 305th Engrs., 80th Div., Eng. Water Dept., East Orange, N. J.
RHYS, C. O.
Capt. E. O. R. C., The Diamond Match Co., Bakerton, Ohio.
RICHARDS, KEENE.
Capt. S. O. R. C., Div. Supt. Public Service Co. of Northern Illinois, Chicago, Ill.
RICHARDSON, EDWARD B.
Maj. Am. Exp. Forces.
RITTENOUR, FREDERICK H.
Capt., E. O. R. C., Instr. Dept. of Marine Eng. & Naval Constr., U. S. Naval Academy, Annapolis, Md.
ROBERTS, THEODORE C.
Maj. E. O. R. C.
ROBISON, CHAS. D.
Capt. E. O. R. C. 306th Engrs., Member Firm Forstall & Robison, N. Y.
ROGERS, JOHN D.
Capt. Ry. Engrs., Va. Ry. Co., Princeton, W. Va.
ROOP, J. CLAWSON.
Capt. 17th Engrs. Exp. Force, Eastern Rys. Co., Pottsville, Pa.
ROOT, VIRGIL A.
Capt. Ord. Dept., U. S. R., Engr. Dept., Warner & Swasey Co., Cleveland, Ohio.
RORTY, M. C.
Maj. O. O. R. C., Spec. Agt. Am. Tel. & Tel. Co., N. Y.
ROSE, C. E.
Capt. E. O. R. C., V. P. and Mgr. Ark. Cold Storage Co., Little Rock, Ark.
ROSE, W. H.
Lieut. Col. Eng. Corps, in charge Gen. Eng. Depot, Washington, D. C. (Regular.)
ROWELL, L. D.
Capt. E. O. R. C., Prof. El. Eng. Purdue Univ., Lafayette, Ind.
RUSSEL, EDGAR.
Col., Chief Signal Officer, Gen. Pershing's Staff, France. (Regular.)

S

SANDSTROM, CHAS. O.
Capt. Co. L 3rd Reg. Missouri, Laredo, Tex., Mech. Eng., Hunt Eng. Co., Kansas City, Mo.
SCHMIDT, EDWARD C.
Maj. Ord. Dept., U. S. A., Insp. Sect., Carriage Div., Prof. Ry. Eng., Univ. of Illinois, Urbana.
SCHOOL, W. A.
Capt. E. O. R. C., District Mgr. North Coast Pr. Co., Chehalis, Wash.
SCHOEPF, T. H.
Capt. 15th Eng. U. S. Exp. Force, Gen. Engr. Westinghouse El. & Mfg. Co., Pittsburgh, Pa.
SCOTT, ROSSITER S.
Capt., E. O. R. C. V. P., G. M. Coastwise Shipbuilding Co., Baltimore, Md.
SCALEY, P. THWAITES.
Capt. E. O. R. C. (Wash.), Oper. Supt. Illinois Northern Utilities Co., Dixon, Ill.
SEDGWICK, H. A.
Prov. Lieut. Comm., U. S. N. R. Force, Asst. Supt. Cutler-Hammer Mfg. Co., Milwaukee, Wis.
SEES, JOSEPH F.
Capt. O. O. R. C., Asst. Supt. of Small Arms Ammunition, Frankford Arsenal, Bridesburg, Pa.
SHALLCROSS, WM.
Capt. E. O. R. C., 26th Engrs., Eng. Northwestern Mfg. Co., Milwaukee, Wis.
SHAW, CARROLL H.
Capt. E. O. R. C., Mgr. Minnesota Utilities Co., Chisholm, Minn.
SHEEDY, M. M.
Capt. Engs. U. S. R., Co. C, 21st Reg. Engrs., Lt. Ry., Lab. Insp. Pa. Mfrs. Assoc., Casualty Ins. Co., Phila., Pa.
SHEPPARD, HARRY S.
Capt. S. O. R. C., Asst. Prof. El. Eng., Univ. of Mich., Ann Arbor, Mich.
SHRIEVE, HERBERT E.
Maj. S. O. R. C., Western El. Co., N. Y.
SIMPSON, R. C.
Lieut. Col. 9th Inf. Brigade, Australia Forces, Lecturer in charge Dept. of El. Eng. & Physics, Technical College, Sydney, N. S. W.
SLADE, ARTHUR T.
Capt. Aviation Sect., S. O. R. C., Cons. Engr., N. Y.
SMITH, ALBERT S.
Capt. E. O. R. C., Supt. Bldgs. & Power, Mass. Inst. of Tech., Boston, Mass.
SOMERS, R. H.
Maj. Ordnance Dept. (Regular.)
SPAULDING, H. C.
Capt. U. S. R., Purchase Sect. Gun Div., Ord. Dept., Dist. Mgr. Hooven-Owens-Rentschler Co., N. Y.
SPEIRS, C. W.
Capt. 5th Surrey Vol. Reg., Managing Tech. Director London Works, Morgan Crucible Co.
SPENCER, F. G.
Capt. Ord. Div., U. S. R.
STEVENOT, J. E. H.
Capt. Signal Corps. Philippine Natl. Guard. Constr. El. Eng. Manila, P. I.
STREET, GEO. T.
Capt. 309th Engrs., Western Rep. James Sugden Co., Youngstown, Ohio.
STREETER, ROBT. L.
Capt. Ord. Dept. U. S. R., Rock Island Arsenal.
STRINGHAM, JOSEPH S.
Capt. Ord. Dept. Rock Island Arsenal. Cons. & Min. Eng., Detroit. Mich.
SUTTON, FRANK.
Maj. E. O. R. C., Cons. Eng. N. Y.
SWANN, JOHN J.
Capt. E. O. R. C., V. P. Amer. Arms Corp., N. Y.

T

TATUM, L. L.
Lieut. Comm. U. S. N. R. F., Asst. Chief Engr., in charge of Design, Cutler-Hammer Mfg. Co., Milwaukee, Wis.
TAUSSIG, WM. S.
Capt. E. O. R. C. 114th Engrs., Gen. El. Co., Chicago, Ill.
TAYLOR, WM. T.
Capt. Royal Flying Corps., Chief of El. Service of Pulacayo, Bolivia, S. A.
THOMPSON, JOHN F.
Col. Ordnance War Dept., Cons. Engr. Remington Arms Co., Eddystone, Pa.
THOMPSON, W. R.
Capt. 109th Engrs., Mgr. Eng. & Constr. H. M. Byllesby & Co., Chicago, Ill.
THOMSON, W. H., Jr.
Capt. E. O. R. C., G. M. Kansas City (Mo.) Light & Power Co.
THORNTON, GEO. C.
Capt. 106th Engrs., Eng. Crown Mountain Mining & Power Co., Dohlonega, Ga.
TILSON, HOWARD.
Capt. O. O. R. C., London Guarantee & Accident Co., Ltd., Chicago, Ill.
TINSLEY, JOHN F.
Maj., O. O. R. C. (unassig.). G. M. Crompton & Knowles Loom Works, Worcester, Mass.
TOLTZ, MAX.
Maj. Eng. Corps, Minnesota N. A., Pres. Theto Hy. Eng. Co., St. Paul, Minn.
TOWNSLEY, F. P.
Capt. E. O. R. C., Supt. Teleph. Equip. Pr. Engs., Hawthorne Sta., Western El. Co., Chicago.
TREAT, ROBT. B.
Maj. O. O. R. C., Engr. & Works Mgr. Copley Mfg. Co., Newark, N. J.
TRIPIER, HENRI.
Capt. Artillery, Paris, Sub. Director of Studies in l'Ecole Centrale des Arts et Manufactures, Paris.
TRUSCOTT, HAROLD S.
Capt. 3rd Batt. 4th Inf., Hawaii. Factory Supt. Hawaiian Sugar Co., Makawehi, Kanai, Hawaii.
TUSKA, GUSTAVE R.
Maj. E. O. R. C., Cons. Engr., N. Y.
TWOGOOD, RALPH S.
Capt., E. O. R. C. (Unassig.). Asst. Engr. So. Pacific Co., San Francisco, Cal.

V

VAN WINKLE, EDWARD.
Capt. Eng. Corp. Mobile Army Div. of Gen. Eng. Depot, Cons. Pat. Engr., N. Y.
VAUGHAN, AUBREY W.
Capt. Q. M. U. S. R., Asst. to Dept. Q. M., Boston, Mass, Industrial Eng., Saco-Lowell Shops, Lowell, Mass.
VAWTER, JAMES H.
Capt., E. O. R. C. (unassig.). El. Engr. U. S. Treas. Dept., Washington, D. C.
VICKERY, W.
Capt. U. S. R., Motor Supply Train, Supt. Trinidad (Col.) El. Trans., Ry. & Gas Co.

W

WAGNER, C. E.
Capt. E. O. R. C., Supt. of Plant, Madison (Wis.) Gas & El. Co.
WAGNER, FREDERICK H.
Maj. O. O. R. C., Chief Engr. The Bartlett Haywood Co., Baltimore, Md.
WAITT, ARTHUR M.
Maj. E. O. R. C., Cons. Engr., N. Y.
WALDMAN, C. A.
Capt. Ord. Dept. (Regular.)
WALKEM, GEO. A.
Capt. Royal Engrs. Egyptian Exp. Force, Vancouver, B. C.
WALKER, PERLEY F.
Maj. 314th Reg., N. A. Ft. Riley, Kan., Dean School of Engr., Univ. of Kansas, Lawrence, Kan.
WALL, GEORGE L.
Maj. Ord. Res. C., Chairman, Sub-Committee on Designs & Specifications for Sta. Freight Car Equip., Am. Ry. Assoc.
WALSH, WILLIAM F.
Capt. E. O. R. C., Mech. Expert, Galena Signal Oil Co., Chicago, Ill.
WATNER, OSCAR C.
Capt. Coast Art. (Regular.)
WEBSTER, LAWRENCE B.
Capt. Ord. Insp. Dept. U. S. R. Secy-Treas. Western Ohio Ry. Co., Cleveland, Ohio.
WEINBERG, GEO. S.
Maj. E. O. R. C., Cons. Min. Engr., N. Y. & Mgr. Worthington Pump Co., Ltd., Petrograd, Russia.
WELLS, A. E.
Maj. 121st Inf., Cons. Eng., N. Y.
WESTERVELT, W. I.
Maj. U. S. A.
WHIPPLE, C. EARL.
Capt. E. O. R. C., G. M. & Treas. N. Y. Central Iron Wks., Hagerstown, Md.
WHITEHEAD, J. B.
Maj. E. O. R. C., Prof. El. Eng., Johns Hopkins Univ., Baltimore, Md.
WHITLEY, FREDERIC N.
Maj., 1st Batt. N. Y. Engrs. Engr.-Contr., N. Y.
WHITLOCK, ELLIOTT H.
Maj. 24th Engrs. Reg. U. S. R.
WHITNEY, EARLE F.
Capt., E. O. R. C. (unassig.). Gen. El. Co., Portland, Ore.
WHITTED, THOS. B.
Capt. E. O. R. C., Mech. Engr., Charlotte, N. C.
WHYTE, JESSE S.
Capt. Co. F 310th Engrs.
WILBER, DANA W.
Capt. E. O. R. C., Rochester, N. Y.
WILLIAMS, H. E.
Capt., F. A. O. R. C. Pres., Ry. Mtls. Export Corp., N. Y.
WILSON, EVERITT W.
Capt., E. O. R. C., Gen. Supt. R. N. Hebard & Co., Inc., Panama.
WILSON, HENRY C.
Maj., Coast Art. Cons. Engr., N. Y.
WILSON, PERCY J.
Capt. 304th Engrs., Pr. Sales Engrs., Lowell (Mass.) El. Lt. Corp.
WOODHULL, L. R.
Capt. E. O. R. C. 304th Engrs., Bethlehem (Pa.) Steel Co.
WOOLSON, CLIFFORD G.
Capt. Co. A, 104th Engrs., S. E. Dept., 29th Div., U. S. A.

Y

YODER, THOS. M.
Capt. Ord. Dept. N. A., New York, N. Y.
YUNDT, GEO. J.
Maj. S. O. R. C., Chief Engr. Southern Bell Tel. & Tel. Co. & Cumberland Tel. & Tel. Co., Atlanta, Ga.

Z

ZIMMERMAN, OLIVER B.
Capt. E. O. R. C.
ZORING, H. H.
Capt. Ord. Dept. (Regular.)

Utilities Turn to Regulatory Commissions

Success with Which Privately Owned Properties Emerge from Growing Economic Pressure Depends Largely on Judicial Spirit and Breadth of Vision of Those Intrusted with State Regulative Powers

BY WILLIAM J. HAGENAH
Of Hagenah & Erickson

THE year 1917 has witnessed the beginning of what promises to be the most critical period through which privately owned utilities have passed. The forces which have contributed to this condition are not new, although the great war in which we are now engaged has given them impetus and added significance, both because of the acute conditions resulting from our direct participation in the war and because of the economic and social readjustments which will doubtless follow it. The measure of success with which these properties emerge from the growing economic pressure depends largely on the judicial spirit and breadth of vision of those intrusted with the administration of our present machinery of regulation. The guidance and protection of this industry, if the present form of regulation is to succeed, call for sound reasoning and a firm adherence to fundamental economics. Such action as has been taken with respect to these conditions in 1917 gives a favorable promise, but the real test will come in 1918 and probably during two or three years thereafter.

For over twenty years officers and owners of public utility properties, both municipal and private, have beheld with serious misgivings the steady increase in commodity prices and the corresponding decline in the purchasing power of the dollar. During the greater part of this time they have had two methods of protection—reduction of operating expenses through increased efficiencies, and increases in rates. By reason of the larger and more efficient apparatus, costs have now been reduced as far as our present knowledge will permit, and it will require a discovery of radical and far-reaching consequences to give promise of further decreases. Increases in rates by the utilities, a course still open to commercial and industrial establishments through price advances, have been checked by regulatory legislation. At present, therefore, when confronted by tremendously increased operating expenses and emergency regulation designed to reduce the service output, and by legal restrictions preventing an increase in rates, utilities behold net earnings declining to the vanishing point and turn to the regulatory commissions as their only avenue for early relief.

The Real Test of Regulation

Five years ago in a similar article the economic movement which gave rise to public service commissions was described as consisting of three stages—first, the period of public protest against the early conditions of unrestricted utility operations; second, the period of legislation during which regulatory statutes were enacted and their administrative machinery developed, and, third, the period during which the industry has been seeking to adapt itself to the new legislation. We are at the present time still in the third stage, with the question as to whether the present machinery for regulating utilities is successful as yet not definitely answered. Regulation prior to 1917 has had to deal mostly with the adequacy of service and with such periodical reductions in rates as were found justified by the economies and profits resulting from operating efficiency and from the business development incident to the growth of the industry in the community served. Students of the price movement, however, have been calling attention for a number of years to the conditions which were operating greatly to reduce the net earnings and foreshowing their ultimate extinction unless greater attention were paid to the steady rise in prices with its effect on earnings and on the cost of securing new capital.

The Breaking of the Storm

The storm which for years has been gathering with increasing darkness on the utility and railroad horizon has now broken in all its fury under the strain of war, and with it has come the real test of the present method of regulation. We have entered a period of great economic stress and the end is not in sight. Prices have scored greater advances during the last eighteen months than during the twenty years preceding, which years represented a period of almost uninterrupted advancing prices. The cost of coal, copper, steel, chemicals and other supplies has doubled and in some instances trebled. Wages have been advanced more rapidly than at any other period in the history of the country and yet have hardly kept pace with prices. The demands of labor are constantly increasing, but its efficiency in most instances is decreasing. New forms of taxation have been devised, while the old forms, already burdensome, are being greatly increased. While the industrial power of the country has been developed to a degree previously thought impossible, and under such conditions profits in many lines have temporarily risen, securities of all kinds have experienced the greatest decline in almost a generation. In the midst of these conditions the purchasing power of the fixed unit of income has sunk to its lowest level and the cost of capital has correspondingly advanced. The financing of even normal requirements is practically impossible now and will be extremely difficult at anything less than prohibitive rates for a number of years to come.

The present utility problem, however, is not alone one of increasing commodity prices and costs of capital. Active measures are now also being taken to restrict operations which directly curtail gross earnings. Plant extensions not required directly or indirectly for national purposes are discouraged. Sign lighting and boulevard illumination are restricted. Even in the lighting of homes and offices it is urged that the greatest economy be pursued, and to encourage further the saving of energy it is suggested that clocks be advanced one hour. To the extent that the capacity thus released

may be devoted to power purposes in industries made necessary by the war no present loss may be sustained, but normal conditions in this respect will not promptly be restored by the discontinuance of war contracts.

These are some of the problems which confront the utilities and commissions, but they are not all. The recent abrupt decline in net revenue and the increasing cost of capital are the immediate effects of our present war pressure and are therefore to some extent temporary. There are, however, indications that the disturbed conditions in the utility field this year are due as much to the fear of the conditions which are to follow the war as to the war itself. War is the greatest leveler. Already the structure of supply and demand has practically collapsed. The government has established maximum prices for wheat, steel, copper, coal and other commodities and has accomplished what competition at this time could not do. It is taking over the management of the railroads and other carriers. It will purchase equipment for their use, direct joint use of facilities wherever necessary, and order extensions where most needed for the greatest public good.

Just as it controls the price for the transportation and fixes in addition the price for the supplies that enter into it, so it can and probably will fix the salaries and wages of its employees. If, when the necessity requires, it sees fit to take over the transportation system, it may also take over the utilities, operating them for the general public good, fixing not only their rates but the cost of their supplies and their labor, and if such course is successful as a war measure, the public may come to believe that the same arrangement would be equally desirable for the days of peace.

CONSTRUCTIVE SPIRIT OF THE COMMISSIONS

In the face of these conditions it is encouraging to note the broad constructive spirit with which many of the public utility commissions have approached these problems. Prior to 1917 regulation of rates generally meant regulation downward. The overwhelming majority of cases resulted in reductions in rates, the important instances where increases were granted being so few as to incite each time wide public mention. During 1917 public service commissions have given unusual consideration to price movements and their effect on the public utilities, and as a result many commissions have recently readjusted rates on the basis of the new conditions. In this connection it is worthy of mention that the public criticism which it was always expected would arise in great volume should the commissions grant frequent increases has in practically every instance failed to appear, showing at once a general public understanding of the unfavorable conditions which have been surrounding public utilities and a degree of confidence in the decisions of the commissions that augurs well for the future. If regulation in its present form is to be permanent, it must be realized that the rates which may be reduced when profits are large must be increased when economic conditions endanger a fair return on the investment. The greatest stumbling block to all regulation will be definitely removed when once the public understands that, like the man who may lead a horse to water but cannot make him drink, it may take great liberties with the investment which the utility has already made but no amount of legislation, either that already on the statute books or that which is constitutionally possible, can compel a dissatisfied investor to supply additional capital.

An analysis of the decisions made in the year just closed shows that the commissions have allowed numerous increases in rates and in some cases have modified standards to the end that operating expenses might be reduced. In over twenty-three different states have increased electric light and power rates been made effective, and increased traction and interurban fares have also frequently been allowed. The increased revenues thus made available have been substantial and often cover a large part, if not all, of the increased costs which had been encountered up to the time when the applications were made. In some states the increases were allowed after exhaustive investigations, but in most cases they became effective by the mere filing of the amended schedules and the absence of protests during the period prescribed by statute. In each case, whether actively or passively favorable to the increases, the commissions have shown a growing appreciation of the problems confronting the utility managements. As offsetting these increases, there have been a few instances of rate reductions, and further reductions will doubtless be made even during the period of the war, for there are still instances where rates covering specific classes of service are apparently too high or where by means of the camouflage of involved schedule forms the entire schedule is being maintained on what appears to be an unreasonable basis.

That the utility commissions should have responded so promptly to the necessities of the case gives promise of the ultimate success of state regulation, unless the social problems growing out of the war should lead to a period of prolonged radical legislation aimed at all corporations but especially at public service corporations. In this year of crises the utilities subject to state regulation have fared far better than corporations dependent on assistance from national bodies or those subject to regulation by municipalities. Additional legislation is still desirable and conditions are rapidly making this urgent. A more general control of the issuance of securities is needed for the protection of both the public and the utility, for the rights of capital are best safeguarded where the commissions are charged with a degree of responsibility over it. Likewise, it may be found both advisable and necessary to legislate with respect to labor, either by adjusting its wages definitely on a basis which varies with the profits of the utilities or by making labor share directly with capital the responsibility for the utilities' success.

Most of the utilities have experienced substantially reduced net earnings, but this is not a time when reductions in earnings traceable to temporary conditions should cause grave concern. When thousands of men are dying in battle and billions of national wealth are being spent for the protection of human rights, utilities, like individuals, must take their place in the ranks and contribute with all for the greatest public good. But it is of the utmost importance at such a time that the fundamental rights of property shall be sustained, that there shall be preserved to the owners the true value of their investment, and that in so far as is possible without doing injustice to the public there shall be made available that measure of return which will maintain the properties and enable them to best meet the requirements of the public. This the commissions have done in 1917.

Light and Power Earnings $470,000,000 in 1917

Output Increases During Year by 20.9 Per Cent, to Approximately 27,000,000,000 Kw.-hr.—October Income, $39,300,000, Output 2,040,000,000 Kw.-hr.

RETURNS to the ELECTRICAL WORLD from 50 per cent to 60 per cent of the central-station industry of the United States indicate that the earnings from the sale of energy for electric lighting and power during 1917 were between $470,000,000 and $475,000,000, an increase over 1916 of 14.5 per cent, or about

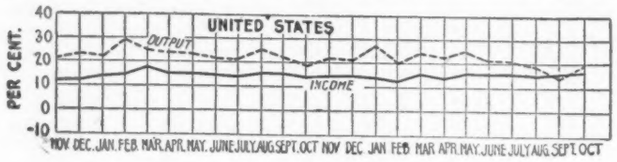


FIG. 1—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES

$60,000,000. The output of the industry which was actually sold was in the neighborhood of 27,000,000,000 kw.-hr., which is 20.9 per cent, or about 3,500,000,000 kw.-hr., greater than the output in 1916. These are absolutely the largest increases in gross earnings and output ever registered in the electric light and power industry. In fact, the increase in earnings this year over last year was almost as large as the entire earnings of the entire industry fifteen years ago, while the output increase is greater than the entire output of the industry ten years ago.

The latest month for which the ELECTRICAL WORLD has figures is October. While not so large a percentage of companies reported for that month as had been reporting previously, owing to lateness in getting out blanks, the reports received indicated earnings from the sale of light and power of $39,300,000 for October last, in comparison with $34,300,000 for October, 1916, an increase of 14.4 per cent. The output for last October was 2,040,000,000 kw.-hr., an increase of 19.7 per cent over October, 1916.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

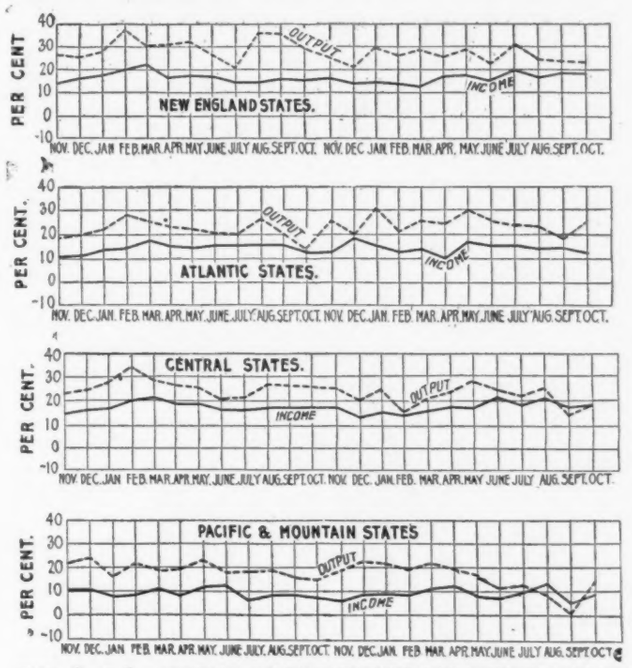
	Percentage of Industry Represented	Income from the Sale of Energy			Kw.-Hr. Output		
		1916	1915	Per Cent Increase	1916	1915	Per Cent Increase
Oct.	64	22,882,000	20,164,000	13.5	1,347,502,000	1,125,132,000	19.9
Nov.	64	24,819,000	21,744,000	14.4	1,396,537,000	1,148,221,000	21.7
Dec.	62	25,306,000	22,029,000	15.0	1,345,883,000	1,112,280,000	21.0
1917		1917	1916		1917	1916	
Jan.	63	27,408,000	23,969,000	14.4	1,495,829,000	1,180,884,000	26.7
Feb.	63	25,204,000	22,295,000	13.1	1,240,995,000	1,036,014,000	20.0
March	64	23,949,000	20,913,000	14.6	1,409,129,000	1,139,453,000	23.6
April	63	22,927,000	20,165,000	13.8	1,328,092,000	1,085,554,000	22.5
May	62	23,369,000	20,307,000	15.2	1,459,085,000	1,163,483,000	25.3
June	63	23,279,000	20,168,000	15.6	1,407,860,000	1,165,629,000	20.8
July	63	22,768,000	19,680,000	15.8	1,397,482,000	1,159,410,000	21.5
August	63	22,718,000	19,972,000	13.8	1,451,928,000	1,223,373,000	18.7
Sept.	63	23,861,000	20,896,000	14.3	1,376,370,000	1,219,117,000	13.0
October	51	20,026,000	17,509,000	14.4	1,037,206,000	866,871,000	19.7

Even though the industry has grown to more than two and one-half times what it was five years ago, the percentage of increase is still high. The maintenance of a constantly higher percentage increase indicates an industry which is growing much more rapidly in gross business.

TABLE II—CENTRAL STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States (Illinois Excluded)			Percentage of Industry Represented	Pacific and Mountain States		
			1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase
INCOME	October	65	$2,684,000	$2,331,000	15.2	65	$ 8,887,000	$7,930,000	12.1	56	$6,968,000	$5,895,000	18.2	87	$4,213,000	$3,889,000	8.3
	November	65	2,912,000	2,516,000	15.7	65	10,061,000	8,859,000	13.5	56	7,410,000	6,313,000	17.4	87	4,246,000	3,947,000	7.5
	December	65	3,203,000	2,814,000	14.0	66	11,059,000	9,348,000	19.6	56	7,898,000	6,997,000	13.0	75	2,987,000	2,735,000	9.3
	1917		1917	1916			1917	1916			1917	1916			1917	1916	
	January	64	3,181,000	2,762,000	15.1	66	11,400,000	9,874,000	15.6	56	8,081,000	7,013,000	15.2	86	4,602,000	4,020,000	9.5
	February	64	3,039,000	2,686,000	13.1	65	10,249,000	9,021,000	13.6	55	7,471,000	6,530,000	14.4	86	4,284,000	3,926,000	9.2
	March	64	2,861,000	2,547,000	12.3	65	10,203,000	8,902,000	14.7	56	6,692,000	5,754,000	16.5	86	4,193,000	3,780,000	11.0
	April	64	2,756,000	2,357,000	17.0	65	8,601,000	7,765,000	10.7	56	7,132,000	6,094,000	7.0	86	4,282,000	3,821,000	12.1
	May	64	2,640,000	2,253,000	17.2	65	9,495,000	8,118,000	16.9	52	6,912,000	5,914,000	16.9	86	4,173,000	3,883,000	7.5
	June	64	2,641,000	2,290,000	15.4	65	9,281,000	8,017,000	15.7	53	6,718,000	5,563,000	20.9	86	4,480,000	4,174,000	7.4
	July	64	2,634,000	2,205,000	19.4	65	8,919,000	7,687,000	16.1	53	6,690,000	5,643,000	18.6	86	4,482,000	4,110,000	9.2
	August	64	2,352,000	2,025,000	16.2	65	9,021,000	7,881,000	14.5	53	6,910,000	5,718,000	20.9	87	4,819,000	4,270,000	12.9
	September	64	2,811,000	2,362,000	19.0	64	9,139,000	7,963,000	14.7	53	7,232,000	6,177,000	17.1	87	4,636,000	4,355,000	6.4
	October	47	2,304,000	1,936,000	18.8	44	7,565,000	6,729,000	12.5	47	7,008,000	5,948,000	17.9	75	3,098,000	2,852,000	8.7
KW.-HR. OUTPUT			1916	1915			1916	1915			1916	1915			1916	1915	
	October	65	107,756,000	83,705,000	28.8	65	426,151,000	373,705,000	14.2	56	408,364,000	324,509,000	25.9	87	355,014,000	306,828,000	15.8
	November	65	111,873,000	89,015,000	25.7	65	533,252,000	424,746,000	25.6	56	415,491,000	334,044,000	24.4	87	346,847,000	293,518,000	18.2
	December	65	117,763,000	97,387,000	21.0	66	535,410,000	444,923,000	20.4	56	425,510,000	354,258,000	20.0	75	256,006,000	206,838,000	23.8
	1917		1917	1916			1917	1916			1917	1916			1917	1916	
	January	64	120,211,000	93,163,000	29.1	66	564,699,000	429,432,000	31.5	56	437,923,000	351,335,000	24.5	86	363,094,000	298,990,000	21.4
	February	64	110,114,000	88,324,000	24.7	65	418,407,000	341,877,000	22.5	55	373,988,000	323,158,000	15.8	86	326,891,000	274,079,000	19.3
	March	64	121,434,000	95,515,000	27.2	65	539,028,000	425,376,000	27.0	56	383,046,000	311,841,000	23.0	86	365,541,000	301,721,000	21.3
	April	64	108,968,000	87,237,000	25.0	65	449,445,000	362,752,000	24.0	56	390,103,000	317,505,000	22.9	86	368,557,000	309,474,000	19.1
	May	64	110,991,000	86,675,000	28.3	65	527,004,000	405,719,000	30.3	52	415,795,000	325,986,000	27.7	86	394,554,000	336,541,000	17.3
	June	64	106,817,000	87,345,000	22.4	65	496,784,000	392,905,000	26.5	53	393,770,000	318,316,000	23.6	86	399,622,000	358,727,000	11.2
	July	64	109,399,000	83,451,000	31.4	65	494,965,000	396,538,000	24.8	53	379,087,000	311,931,000	21.5	86	412,635,000	366,237,000	12.7
	August	64	105,848,000	85,113,000	24.5	65	514,254,000	420,806,000	22.3	53	415,966,000	333,549,000	24.7	87	413,462,000	381,353,000	8.3
	September	64	114,339,000	92,319,000	24.0	64	482,112,000	405,070,000	19.0	53	399,480,000	345,953,000	15.5	87	379,221,000	374,685,000	1.4
	October	47	86,104,000	69,957,000	23.2	44	328,937,000	263,070,000	25.2	47	394,560,000	334,550,000	18.0	75	225,640,000	197,808,000	14.0

The necessity for a sure supply of power and a quick supply, coupled with the coal situation, has been responsible perhaps more than anything else for the growth of the central station industry during 1917. Large, however, as the industry has grown, it is by no means so large as it would have been had there been available additional capital and additional equipment sufficient to supply the demand. Many companies have found it necessary to refuse to take on additional loads because of the now overloaded conditions of the plant. How much greater the output would have been and the consequent earnings, had money and equipment been



FIGS. 2 TO 5—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

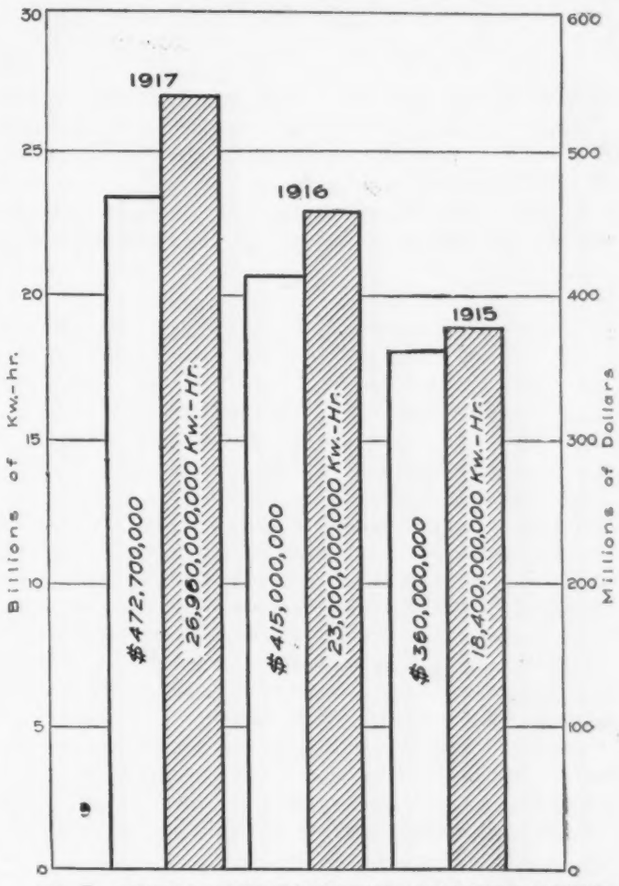


FIG. 7—CENTRAL STATION EARNINGS AND OUTPUT DURING 1915, 1916 AND 1917

in ready supply, there is no way to tell, but from the reports that come in to the ELECTRICAL WORLD it is evident that the figures here presented by no means represent the entire demand which was placed on the electric light and power industry.

Local conditions of strikes and inability to obtain sufficient labor supply have acted in many instances to cut down power demand and, therefore, central station output. This is clearly evidenced by the returns for August and September from the Far Western States.

The accompanying diagram shows graphically the growth of the industry during the last three years, while chart No. 1 shows comparatively the monthly income and output of the industry during 1917 as contrasted with 1916. The remaining curves show graphically by sections the percentages of increase in the industry over the corresponding month of the previous year as contained in Tables I and II.

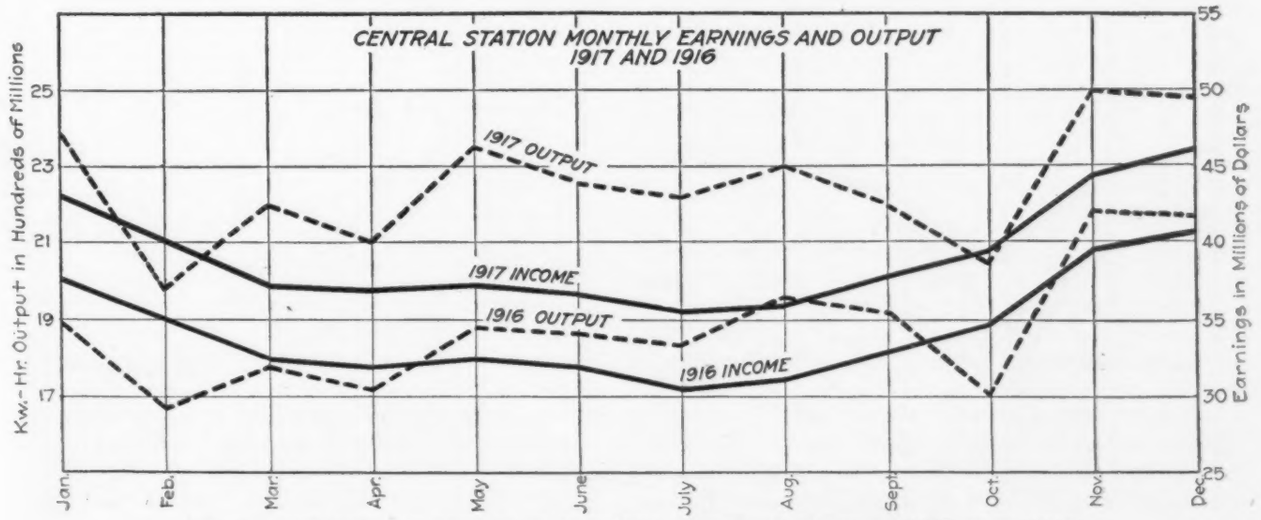

CENTRAL STATION MONTHLY EARNINGS AND OUTPUT
1917 AND 1916
1917 OUTPUT
1917 INCOME
1916 OUTPUT
1916 INCOME
Kw.-Hr. Output in Hundreds of Millions
Earnings in Millions of Dollars
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

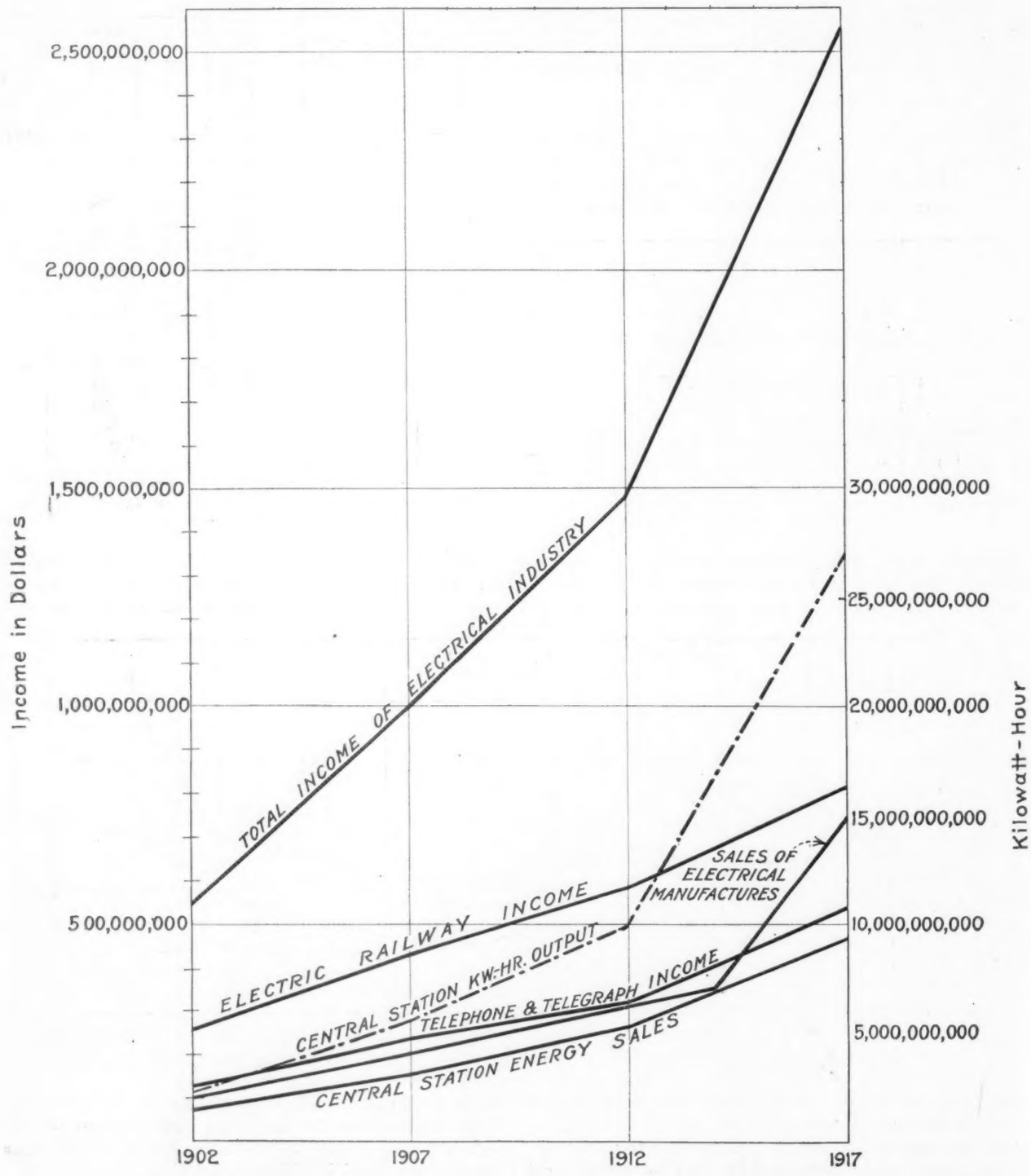
FIG. 6—COMPARISON OF RESULTS OF OPERATION MONTH BY MONTH IN 1917 WITH 1916

Growth of Electrical Revenue in Fifteen Years

Graphical Representation of Earnings for Central Station, Electric Railway, Manufacturing and Telephone and Telegraph Branches of the Industry Since 1902

SINCE 1902 the earnings of the electrical industry have grown, as shown in the graph on this page, from a sum of about $550,000,000 to around $2,550,000,000. These figures include returns from the following branches of the industry: central station, electric railway, manufacturing, and telephone and telegraph. With the exception of those for 1917, which are estimates by the ELECTRICAL WORLD, the values were taken from census figures.

The graph also includes central-station kilowatt-hour output, which in 1917 was in the neighborhood of 27,000,000,000 kw.-hr.



Organizing Operating Staff to Meet Emergencies

Means for Assuring Communication with Different Parts of System—How Trouble Reports Are Handled—Operating Data Plotted in Order to Aid Analysis of Conditions

BY E. P. PECK
Superintendent of Operation Georgia Railway & Power Company

IN THE course of a few years the system of the Georgia Railway & Power Company has grown from a small utility furnishing energy to Atlanta and a section of the neighboring territory to a great corporation consisting of six interconnecting generating plants, purchasing power from two companies, exchanging power with another and delivering power to a fourth company. Every municipality within its territory is being supplied with energy, as is also practically every industrial plant. Important plants which have recently contracted for energy that are essential during the present crisis and require continuous service are in the cotton-mill, steel, mining, fertilizer and cotton-oil industries. In round numbers, the company has increased its output in 1917 approximately 86,000,000 kw.-hr., as against 23,000,000 kw.-hr. in 1916, a record year. The estimated load for 1918 is 258,-300,000 kw.-hr.

KEEPING PACE WITH GROWTH

Keeping pace with this enormous growth of the system and insuring continuity of service at all times have been the big problems confronting the operating department. These have been solved, however, by organizing the department as explained below.

The operating department of the Georgia Railway & Power Company has three main divisions—operating proper, station and substation maintenance and repairs, and operating records. The hydroelectric stations and substations, transmission lines, overhead and underground distribution are maintained by other departments, although the operation of all is directed from the load dispatcher's office.

The system operation is under the control of a chief load dispatcher, who may be considered on duty all the time and whose presence is required in the dispatcher's office during the morning and afternoon peaks. He is assisted by three load dispatchers, who work in eight-hour shifts. Two clerks work in eight-hour shifts from 6 a.m. to 10 p.m., handling the customers' trouble reports, arc-lamp outages, etc.

Regular operating instructions, like cutting in and cutting out machines, lines, etc., are given by the dispatcher on duty. During serious trouble operations are handled by the chief load dispatcher directly, or indirectly through the dispatcher on duty.

In the dispatcher's office is a large map covering one wall of the room which shows all lines, stations, company substations and large customers' transformer stations. Detail prints show the layout of each station and substation, all switching points on the lines, telephone booths, etc. There is also a plug board for keeping track of machines and lines in service.

The dispatchers keep an all-station report giving the hourly loads on each line and station in the system. The "system log," which is made out in this office, shows the time of all switching and interruptions and is a record of all clearance orders, and in fact everything of importance occurring on the system.

In addition to five telephones connecting the office with the Bell Telephone and Atlanta Telephone companies' exchanges, there is a private-line telephone switchboard on the dispatcher's desk connecting with all of the company's stations, substations, shops, trouble stations and offices of the electric department officials. The private lines are used for general system operation. One interesting feature of the telephone system is that the high-tension telephone lines, which parallel the 110,000-volt power lines, are so fully protected that the lines have been operated in series with a 3-mile (4.8-km.) underground telephone cable to the dispatcher's telephone board for several years without having a single case of cable or switchboard trouble due to high voltage from the overhead lines.

Instructions covering the procedure to follow after interruption to any parts of the service are provided at each station. The instructions cover the method of clearing lines or apparatus in trouble and restoring service as far as possible. The operators are told what to do in case telephone connection with the dispatcher's office is interrupted. The dispatcher knows that, if he cannot communicate with a station to give instructions regarding the restoration of service, certain operations will be made in a given order, so he can handle the rest of the system accordingly.

A series of instruction booklets are being prepared, one for each station, which tell each operator in detail how to start and operate every individual machine in his station. As some of the stations have reciprocating engines, turbines, railway rotaries, 2300-volt customers' circuits, arc circuits and supply lines from other stations, these instructions will be somewhat bulky. However, it has been found that such written instructions are necessary, at this time particularly, since a large number of changes are being made continually in the operating force.

HOW TROUBLE REPORTS ARE HANDLED

All reports of trouble in any part of the company's system, including distribution, are received at the dispatcher's office. Trouble reports from the customers are turned over directly to a group of troublemen who report back to the load dispatcher. When trouble occurs on a transmission line the load dispatcher gives the transmission-line troublemen instructions regarding sectionalizing the lines for tests, and in case of ordinary troubles he handles all of the repairs. If the trouble is extensive, however, it is referred to the superintendent of transmission, who takes charge of the repair work. All transmission-line troubles are reported to the transmission department, even though the dispatcher is handling the details. All station and substation trouble reports are passed through to the test and repair department.

The test and repair department has a well-equipped repair shop and testing laboratory, with a large force of repairmen and testers. This department locates and repairs all troubles in the local station and substation apparatus and often assists other departments in locating and repairing troubles of an unusual nature in their divisions of the work. The department has had to enlarge its facilities very greatly since the beginning of the war.

Pieces of equipment are being repaired and worked over in the shops at present which in former times were considered absolutely beyond repair. An illustration of this is a transformer which had a hole burned through a section of the primary winding, leaving a number of turns open and the ends separated by several inches. These turns were repaired by welding in new sections of copper, wrapping with silk tape and adding new coil insulation. After making the repairs, the transformer was given a severe test and put back in service. The total time of repairs was about three days, whereas several months would have been required to obtain a new coil from the factory. Repairs of such a nature would not have been considered four years ago.

This test and repair department also makes weekly inspections of all of the company's rotary converters, paying particular attention to the alternating-current and direct-current brushes and circuit breakers. The relays on all lines and machines are subjected to an operating test weekly and to a thorough check test by a tester at regular intervals.

Inspecting the Stations

At least once every week a station inspector visits all of the stations in the Atlanta district, inspecting generators, rotaries, transformers, switches, circuit breakers, auxiliary machines, condition of building and structure, general housekeeping, etc. Oil samples are taken from each high-voltage station transformer and break-down tests on the oil conducted every two months. Reports of every inspection are sent to the superintendent of operation, who issues orders to the proper department covering repairs to any defects found by the station inspector.

Records of the loads of all stations are also sent to the operating superintendent's office. A report of the daily output of all generating stations is made, which is sent to the company officials who are interested. In addition, a number of monthly reports are made showing the grouping of load in various divisions. From the kilowatt peak records and the kilowatt-hour records tabulations and curves, showing hourly, daily and monthly load of each different class of service, are made. The monthly curve sheet also shows the water elevation in the storage reservoir.

All who receive the daily load record sheet also receive a daily interruption report. On this sheet are given interruptions to every class of service, the time the service is interrupted and the cause of the interruption. At the end of each month the interruptions are classified according to the district and class of service, and a summary is made with the same classification.

From the daily interruption reports the operating department works up interruption analysis reports which have been found very valuable. One sheet is made out for each system, supply and plant and each hydroelectric distribution line. This makes a total of twenty-six sheets. The analysis shows the number of troubles occurring each month, grouped according to the causes. The total number of interruptions each month and the percentage each month are shown, also the total number due to each cause and the percentage of troubles due to each cause. There has been so much demand for this report that all totals have to be extended and copies sent out each month. A total of more than thirty monthly reports is sent out from the operating office.

Operating Data Plotted to Aid Analysis

Very close account is kept of all costs in the operating department. The data are plotted on curves which show the average monthly cost of the previous year and labor and material cost for each month of the current year. There are twenty-nine of these curve sheets, showing salaries and expenses of the operating department proper, salaries and expenses of the testing and repair department, operating expenses of each station and substation, and repair and maintenance expenses of each station and substation. If any unusual expenses occur during the month, a note is made on the curve showing the reason for the change. This system of keeping expense records has aided considerably in reducing operating expenses at a number of different points.

Form 401-X

GEORGIA RAILWAY & POWER COMPANY

INTERRUPTION ANALYSIS

SERVICE AFFECTED

CAUSED BY	January	February	March	April	May	June	July	August	September	October	November	December	Total	Per Cent
Lightning														
Insulator Failure														
Line Wire Failure														
Atlanta Distribution Lines														
Station Equipment														
Local Substation Equipment														
Hydro Substation Equipment														
Cust. Substation Equipment														
Tall. Interruption														
M. F. Interruption														
Switching Error														
Total														
Per Cent.														
Hrs. Duration Min.														

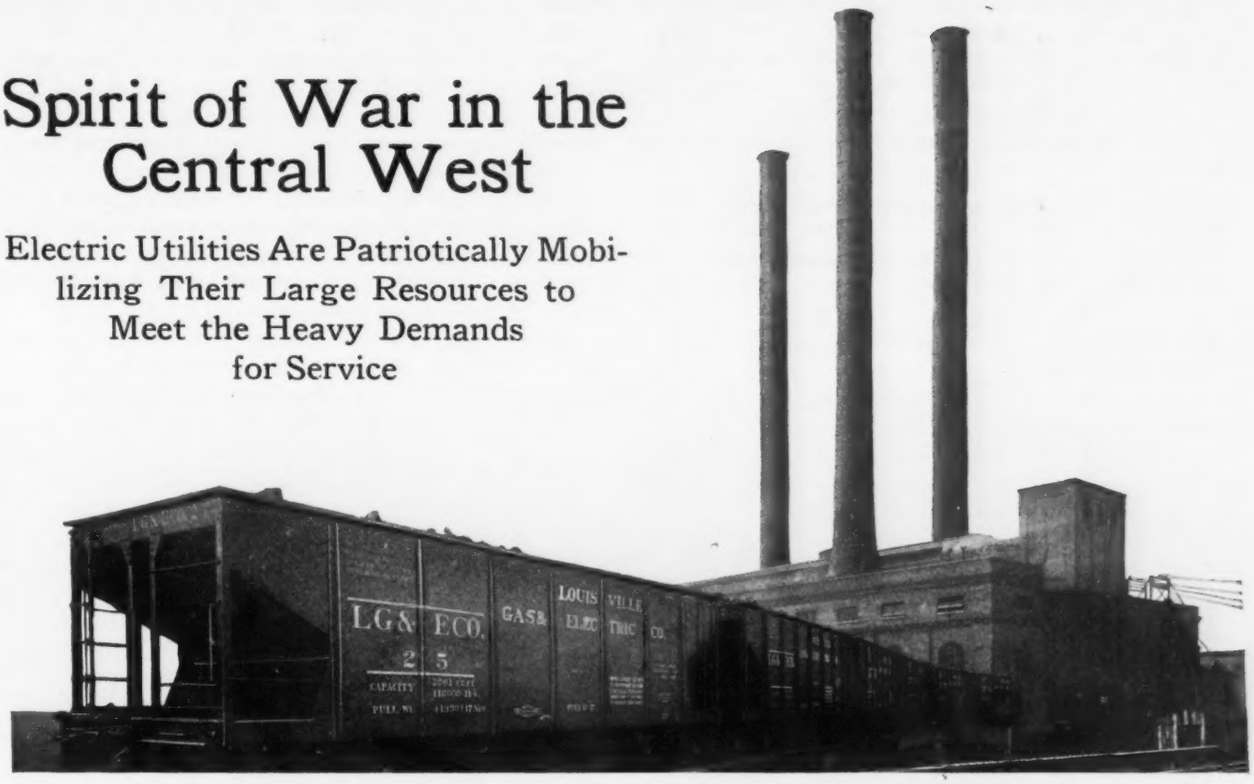
FORM FOR RECORDING ANALYSES OF INTERRUPTIONS ON GEORGIA COMPANY'S SYSTEM

Practically every variable of which a record is kept is transferred to a curve sheet. This, of course, in the aggregate, requires considerable work, but the clearness with which variations are shown and the ease with which these variations may be compared more than overbalance the cost of the work.

Summarizing, the operating department directs the loading and operation of all stations, substations and lines. It maintains the stations and substations in the central part of the system known as the Atlanta district. It keeps the operating records and works up reports on loads, interruptions and costs.

Spirit of War in the Central West

Electric Utilities Are Patriotically Mobilizing Their Large Resources to Meet the Heavy Demands for Service



SINCE the United States declared war against Germany the central stations of the country, especially in the Central West, have been called upon to introduce readjustment measures of considerable importance. They have supplied men, material and money to help win the war. They have been asked to give more service at a time when the essentials of service, being also the essentials of war, are very costly and scarce. At the beginning of the new year they can look back on the past nine months as a period of constructive achievement, of uncomplaining sacrifice, in which a firm foundation was laid for greater service to the national cause. To give a perspective on this creative work it is fitting to enumerate war-conservation measures which these central stations have taken. Such an enumeration will also serve as a guide in shaping future course and will assist in overcoming handicaps which are to be expected in the coming year.

The problems of both labor shortage and lack of capital for extensions are pressing. Both are difficulties so immediate that plans for conservation receive constant attention. The following is a partial enumeration of methods by which capital is being conserved:

New work deferred.
Many free extensions eliminated and the cost of others transferred to the customer.
Unnecessary repairs deferred.
Existing apparatus rearranged to take more load.
Stocks of material on hand reduced to minimum.
Postponement of municipal improvements encouraged.
In new business selection, where possible, of that with off-peak qualities.
Length of time on deferred payment sales plans shortened.
Customers in arrears eliminated.

So far as capital is concerned, the general policy can be summed up in the query, "What can we get along without?" Estimates indicate that in spite of the war something more than 50 per cent of normal capital requirements will be expended in 1918 by some very large companies, because these expenditures are absolutely necessary. The increase in business is so large that companies must provide the physical capacity for it by extensions which over a period of years will approximate the average increase in demand. Contracts made before the war enter into this situation. Work will be deferred in some instances if apparatus contracts can be canceled or set further ahead.

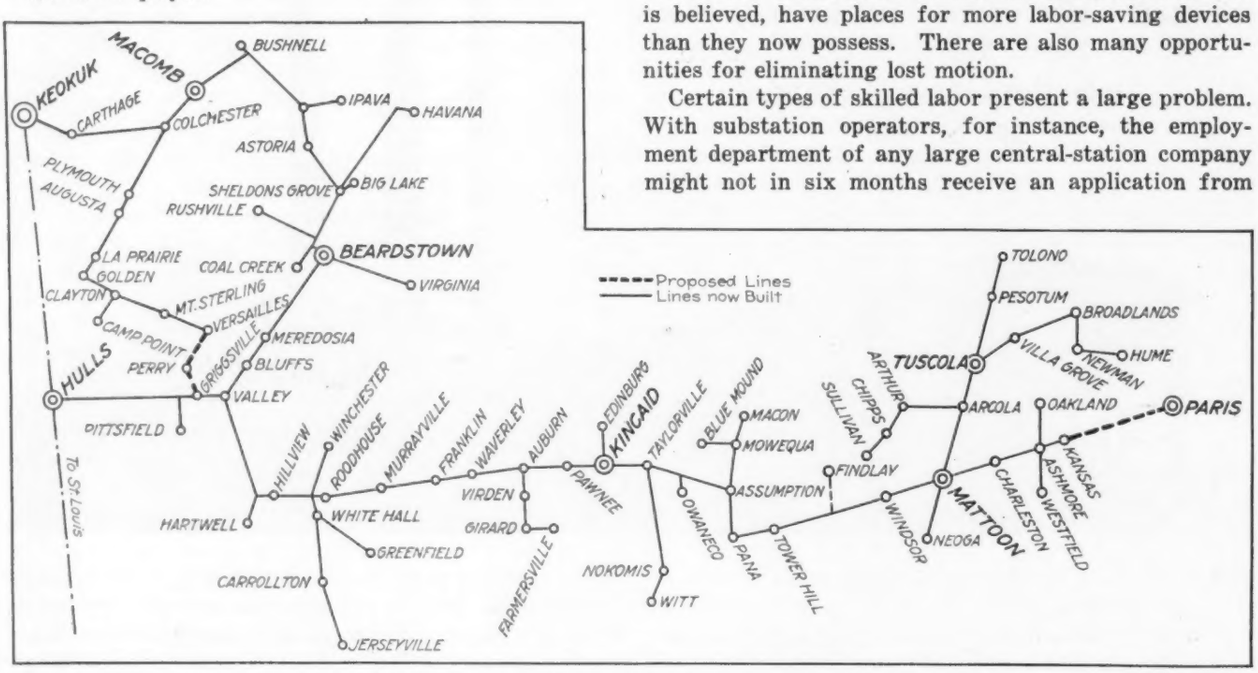
Free extensions have been eliminated in co-operation with the public service commissions, which in general have come to the aid of companies. The postponement of repairs is being handled with judgment, as it is not the intention to permit property to deteriorate through want of necessary replacements. Rearrangement of existing equipment to get greater use factor is being practiced with station apparatus, transformers, etc. The practice of reducing stocks of material is watched carefully, because of uncertain deliveries and transportation. Much effort has been directed to secure co-operation of municipalities in postponing municipal improvements calling for extensive changes in equipment of the companies.

Capital has been conserved further by constant encouragement of the greatest use of power service on an off-peak basis, and manufacturers have co-operated by opening and closing shops at different hours. This not only broadens and reduces power peaks but in some instances is a help to electric railway conditions. Companies have set an example in this practice. In granting credit on larger appliance sales or house wiring, eight months is now considered ample time, whereas twelve months was given formerly. In some cases municipalities have not paid for street lighting for several years, and the illumination has been continued out of civic spirit. It is now being found necessary to stop this.

Some companies have set a "dead line" on all accounts at forty-five days. All of these steps are being taken at a time when new business is clamoring for service.

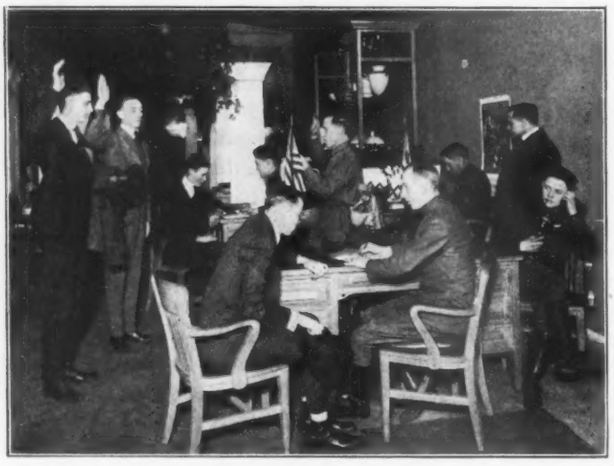
In the labor problem Middle Western companies have been equally resourceful. Many ways have been developed to lessen difficulties arising from the shortage, as for example:

Organization and duties of employees rearranged.
Women employed.



COLCHESTER LINE WILL RELEASE 18,000 TONS OF COAL A YEAR; THIS IS MORE THAN FOUR TIMES THE SAVING MADE BY LIGHTLESS NIGHTS IN CHICAGO

Labor-saving devices and methods installed.
Schools established to train employees.
Young men in schools employed on part-time basis.
Welfare activities curtailed.
Statistical data formerly furnished to all departments have been eliminated.
Branch offices discontinued.
Package charge established for delivery of lamps or appliances.



SWEARING IN RECRUITS IN MERCHANTS' HEAT & LIGHT COMPANY (INDIANAPOLIS) ELECTRIC SHOP

Departments formerly separated have been consolidated under one head. All department heads of one large company were drafted. These positions, that formerly carried $250 a month, were filled by eight-dollar clerks, whose salaries were raised to $125 or $150 at the start. Women were employed in place of the clerks. The attitude of these clerks following the change was not commendable, but the women have proved very efficient. In fact, the experience of the companies is that women in all clerical work, some commercial work, some shop work, and in street-car washing, have been remarkably satisfactory. Most central-station offices, it is believed, have places for more labor-saving devices than they now possess. There are also many opportunities for eliminating lost motion.

Certain types of skilled labor present a large problem. With substation operators, for instance, the employment department of any large central-station company might not in six months receive an application from a man. Yet one large company may lose in the next ten months about 140 trained substation employees. These operators have acquired knowledge that can be gained only through four months of intensive training after an apprentice course which also takes time. This company will train additional substation operators so that it will have men to put in the places of its trained forces as they leave. It is selecting men beyond the draft age. Certain companies in cities which possess vocational schools are employing students one-half day each day in positions for which the school is aiming to fit them. This plan is inexpensive and is said to be successful.

In the conservation of fuel most commendable patriotic work is being done. The lines of this effort may be listed as follows:

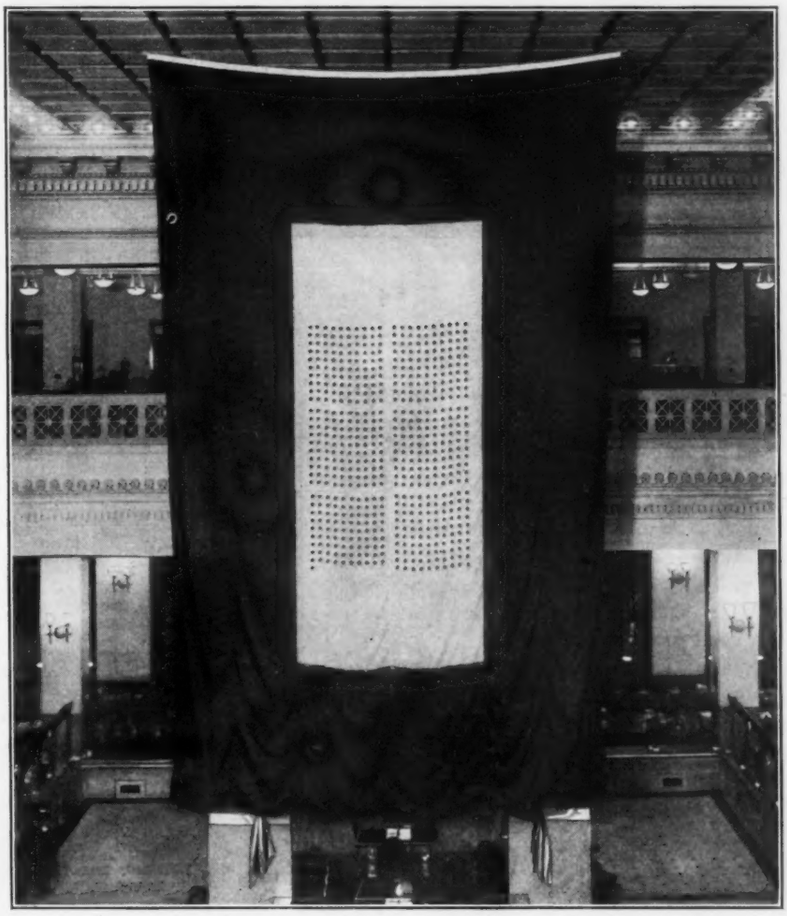
Tying in with water power.
Tying in with large station plants.
Economies in existing plants.
Purchase of mines and cars.
Changing sources of fuel supply.
Placing steam-heating customers on meter basis.
Overhauling office and plant-heating systems.
Enforcing electric sign orders.
"Skip-stop" electric railway service.
Lowering quality of steam-heating service to give 68 deg. Fahr.

A famous low-head hydroelectric plant, hitherto loaded only lightly, has been of great value to surrounding steam plants as a means of coal saving. Soon by a single connection to this plant a central Illinois company will take 3000 kw. off its steam stations. On

the basis of 4 lb. of coal per kilowatt-hour and a 35 per cent load factor, this means an annual saving of 36,000,000 lb., or 18,000 tons, of coal.

In the Lake Superior iron range district transmission lines from a hydroelectric plant are nearing completion to supersede a steam plant which furnished energy for the bulk of the power operations there. In another instance a large company contracted to take all surplus energy from two near-by hydroelectric plants so that not one kilowatt of its hydroelectric rating need ever be idle and no water need go to waste there.

In an Ohio city a lighting company has taken an additional 15,000-kw. demand from the electric railway, permitting the latter to dismantle one plant. Owing to the greater economy of the larger station this change saves 50,000 tons of coal a year. The interconnection of small plants with larger plants all over the central territory is effecting a saving in fuel the value of which in the national crisis cannot be overestimated.



SERVICE FLAG OF THE COMMONWEALTH EDISON COMPANY, CHICAGO

Many companies are pushing line extensions to outlying communities having plants operating at anywhere from 35 lb. to 12 lb. of coal per kilowatt-hour. An interconnected company's average consumption is between 5 lb. and 6 lb. of coal per kilowatt-hour, so that a real reduction is effected. Moreover, coal goes to these small companies in carload lots, and owing to methods of handling it in small towns usually the car is delayed many hours longer than if it had been delivered to a large central electric station. In addition to reducing coal consumption and permitting purchases in larger quantities, and thus effecting another economy, the large central station therefore makes a saving also in the number of cars required to transport coal as well as in the labor involved in car movement.

Fuel economies in existing plants are being made by installation of furnaces, stokers, superheaters and better plant instruments. Results engineering is accomplishing real savings, not only in larger plants but in small towns. One operator with a 2000-kw. station has his plant in such excellent condition that it produces energy on 3.52 lb. of coal per kilowatt-hour. Another company with about 30,000 kw. of rating has reduced coal consumption per unit of energy generated 35 per cent since 1914. While the purchase of mines and cars does not directly conserve fuel, it conserves transportation facilities, which are of equal value and importance. Likewise, if an Illinois company, for instance, changes its source of supply from West Virginia to Illinois or Indiana it assists in the same great movement.

The detailed and painstaking manner in which stations are economizing on fuel is illustrated by the fact that even their own small office and plant-heating systems receive attention.

In the movement to conserve food, electric light and power companies have been of service to the nation. They have:

Used their potential positions as public utilities to urge food saving upon the public.

Started war gardens and encouraged others to do so.

Withheld admittedly fair rate advances for electric cooking and heating.

Taught home economics classes, especially in canning and dehydrating.

Electric signs, stickers on bills, newspaper advertisements, electric railway car cards, billboards, window displays and "Four-Minute Men's" speeches have been used by central stations to tell people how to save food. Serious and successful efforts were made by a few central stations to put the war-garden movement on a more sane basis in 1917. The spring of 1918 will see much more effort if the plans of the electric companies materialize.

That electric cooking rates have not been raised is a striking fact that even the manufacturers of ranges do not seem to appreciate in its full significance. It is explainable largely on the ground that as electric companies realize the inefficiency of the ordinary kitchen stove as a fuel burner and have helped to educate the housewife away from it and toward the use of an economical electric range, they do not desire to lose now the result of all their work. The continuation of classes in home economics is along the same line.

Liberality in aiding the government and war charity financing was characteristic with lighting companies. From the Central West there were several million-dollar

contributions to both First and Second Liberty Loans. A single concern secured more than 6000 members for the Red Cross. One company gave an electric show and turned over a fine profit to the Red Cross. Other war charities have been supported financially and had the assistance of sales helpers. A movement that succeeded in sending 18,000 Christmas packages to French children was sponsored by an Indiana company. At present the companies are helping to sell thrift stamps.

Men with central-station experience have been particularly needed in the war because of their engineering training. The percentage of forces of the Middle Western companies in service ranges as high as 20 per cent. One company raised a complete unit of engineers and turned it over intact to the government. It has scarcely yet been able to replace the men from its own ranks serving in this body. Besides giving its full share of enlisted men and supplying several majors and lesser officers, the industry is filled with men in non-military and unofficial government work. They are found in every position, from that of guiding executive of the State Council of Defense to clerk on the exemption board. No job is too big, no labor too mean.

Service to Essential Industries

But the large task has been to maintain electric service to essential industries. It is a revelation to see how thoroughly and satisfactorily this has been done. It is also interesting that this phase of the work is not centered in cities. Companies of which little is known, and which must remain unnamed, have held government priority orders on all equipment needed to get certain work completed and energy on new lines. In obscure communities central-station service is proving invaluable in underwear and clothing establishments working on khaki-colored cloth. In the larger cities the same condition prevails to an even greater extent.

At one city in Indiana 80 per cent of the labor employed is absolutely dependent on central-station power. Several companies have reported 35 per cent increase in industrial power load on account of munition business. Another company in an industrial city sold in October 42,213,000 units of service. Of these, 27,353,000 were for industrial power and 6,643,000 for transportation. A very large part of the total central-station output is going to essential industries. Among these are metal mills, mines, powder mills, shipyards, cereal works, cement mills, tire factories, overalls and apron factories, glove factories, producers of automobiles, tractors and tanks, and a thousand others which are perhaps just as essential.

The Lesson of Thrift

Leaders in the industry see the silver lining without overlooking the cloud. They see definite good accruing to central-station companies from the present conservation program. Past growth has been so rapid that capital expenditures have been on a stupendous scale. The present program of saving is certain to bring to the surface investment economies as well as operating economies. It may be expected, in the opinion of Central Western officials, that this program of saving will affect the whole American nation so that when the war is over not only the utility companies but also a large percentage of individuals will have learned a lesson in thrift which no other single force could teach.

INCREASING OUTPUT WITHOUT ENLARGING THE EQUIPMENT

Generator Rating Can Be Increased 10 to 20 per Cent by Precooling Ventilating Air—Expense Entailed Relatively Small

BY JOSEPH T. FOSTER
Public Service Electric Company of New Jersey

THE question of whether to install air washers or humidifiers for conditioning and cooling the air entering generators is particularly pertinent at this time, since by cooling this air the generator capacity may be increased from 10 to 20 per cent. Furthermore, by cleaning the air possible shut-downs for generator cleaning and, what is more serious, possible burn-outs due to heavily loaded, dirty machines, may be avoided. Obviously, then, this is the quickest and cheapest method of increasing power plant capacity, and as electric companies are at this time confronted with long deliveries, delayed shipments due to present transportation conditions and labor shortages, this subject should receive special attention now.

The purpose of central station companies in including the air washer as standard equipment on turbo-generator installations is twofold:

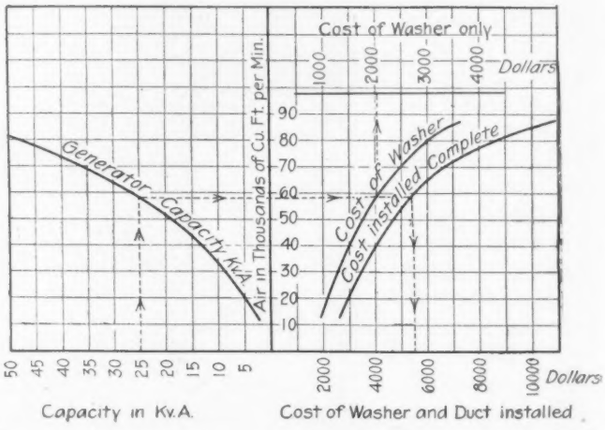


FIG. 1—RELATION BETWEEN KVA. RATING, AMOUNT OF COOLING AIR REQUIRED PER MINUTE, COST OF AIR WASHER AND COST OF WASHER INSTALLED COMPLETE

1. For supplying clean air, free from dust which would coat the windings of the generator and form an insulating covering.

2. For precooling the air by evaporation of water when the air passes through the film of water atomized by the spray nozzles.

Before air-washing equipment was used it was found that the dust and dirt incidental to the unloading of coal and the disposal of ashes fouled the generator by coating the air passages. It was therefore necessary to shut down the generator at least once a year for a period of five or six days for cleaning purposes. In addition to the expense of cleaning, there was the inconvenience and loss of revenue due to shutting down the unit.

Some idea of the cleansing effected by a modern-type air washer can be gained from tests which showed that it was possible to blow several pounds of soot per minute into the intake and have the air at the generator inlet perfectly free from dust.

There is a more or less widespread belief that the

humidifying of the air increases its cooling capacity on the ground that wet air, on account of its higher specific heat, has greater heat-absorbing properties. The effect of this change in specific heat is negligible as far as heat absorption is concerned, because the weight of water vapor present even in saturated air is very small as compared with the weight of the air itself. The difference in the amount of heat absorbed by saturated air as compared with dry air under a given set of conditions is not more than 1 or 2 per cent.

The precooling action of the air washer is, however, of importance. Assume a 12-500-kva. unit which requires 30,000 cu. ft. (850 cu. m.) of cooling air per minute and in which the losses amount to approximately 300 kw. at full load. The heat absorbed per hour, assuming a final temperature of 100 deg. Fahr. (37.8 deg. C.), neglecting the moisture in the air, will be as follows:

I. Air not precooled and entering the generator at 68 deg. Fahr., $0.24 \times 0.07524 \times 1{,}800{,}000(100 - 68) = 1{,}040{,}000$ B.t.u.'s per hour.

II. Air originally at 68 deg. Fahr., but cooled in the washer to 53 deg. Fahr., $0.24 \times 0.07788 \times 1{,}800{,}000 (100 - 53) = 1{,}580{,}000$ B.t.u.'s per hour.

In the first case, the losses absorbed amount to 1,040,000 B.t.u.'s per hour, or 305 kw.; in the second to 1,580,000 B.t.u.'s per hour, or 463 kw. It may be assumed with fair accuracy that the losses are proportional to the squares of the currents; therefore, $I_2^2/I_1^2 = 463/305$, or $I_2 = 1.23I_1$. The terminal voltage is, of course, constant, hence the kilowatt output when the air is precooled will be theoretically 23 per cent greater than with air at the higher temperature. It is more probable, however, that in practice the gain under the conditions stated would amount to 15 per cent, although gains of 20 to 25 per cent have been realized even where the natural conditions were particularly adverse.

The gain in generating capacity obtained by precooling the ventilating air is large, but is obtained by the expenditure of a comparatively small amount of money, as shown in Fig. 1.

The use of the chart is illustrated by the following:

Problem.—Given a 25,000-kva. generator, to find the amount of cooling air required, the cost of the air washer and the cost of the washer installed in place.

Solution.—From the intersection of the vertical line through 25,000 kva. and the curve, run horizontally to the vertical scale. The required air is 58,000 cu. ft. (1640 cu. m.) per minute. Running horizontally to the intersection with the first curve, read on the upper scale the cost of the air washer as $2,050. Running horizontally to the second curve, read on the lower scale $5,500 as the cost of the complete installation.

An illustration of an air-washer installation used in connection with a turbine plant is shown in Fig. 2. The air, which is drawn through louvers and screens at the left, passes through the washer and then through the generator, from which it is discharged direct to the forced-draft blowers in the boiler-house basement.

This method of operation is employed during summer

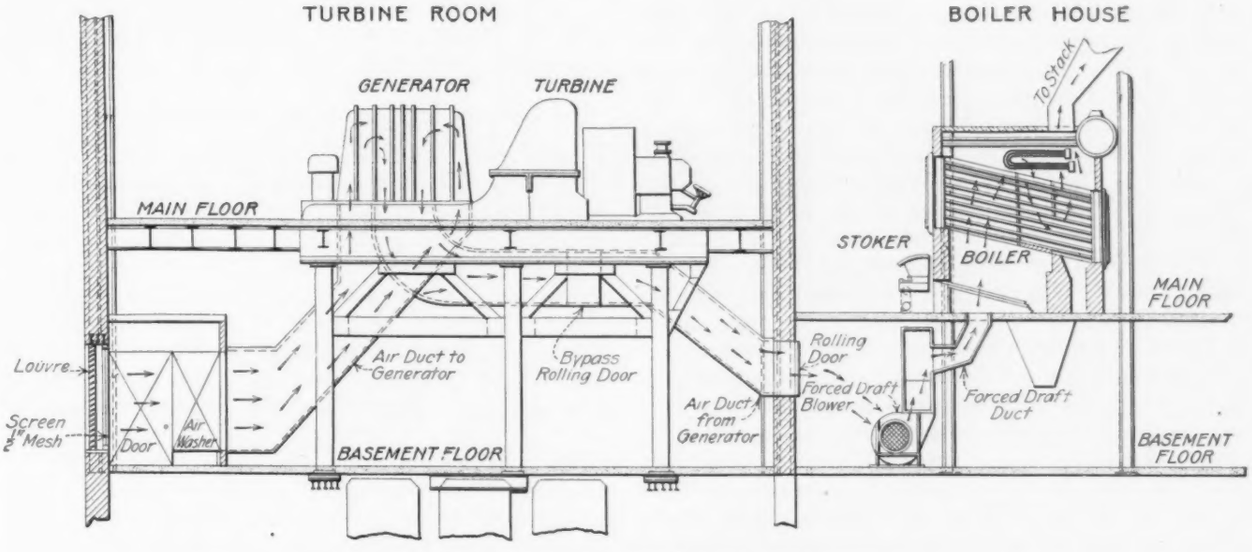


FIG. 2—TYPICAL ARRANGEMENT OF AIR-PRECOOLING APPARATUS FOR TURBO-GENERATOR

weather when it is desired to obtain the coolest air possible for the generator. The discharge to the forced-draft blowers of this quantity of heated air improves the boiler efficiency somewhat and maintains a lower turbine-room temperature.

Under winter conditions the louver opening in the outside wall is closed by a rolling door and the air is drawn into the washer from the turbine room through the side door and discharged from the generator bypass through the sliding door provided for that purpose. Under these conditions the door into the boiler-room basement is closed.

This method of recirculating the air from the turbine room keeps the room at a comfortable temperature. It also does away with the inconvenience of having a partial vacuum in the turbine room due to the removal of large quantities of air from an inclosed space.

The washer to be purchased by the engineer should be of the size specified or recommended by the generator manufacturer, of the heaviest and most durable material, and able to cool the air to at least 85 per cent of the difference between the wet and dry bulbs. At the same time the air resistance through the washer should not exceed 0.375 in. (9.3 mm.) of water and the power consumption should be kept down to a minimum.

Bonus System for the Saving of Coal

Reasons Why Most Systems Are Unsatisfactory—Assigning Definite Tasks to Operators Rather than Requiring Results Has Been Found to Be the Key to Improved Economy in Operation

BY WALTER N. POLAKOV
Consulting Engineer, New York City

THAT the amount of coal available in this country is 17 per cent to 23 per cent short of the requirements is serious enough, but the fact that about one-half of the coal consumed for steam production is used wastefully is appalling. If the needless waste could be eliminated, the national shortage of fuel might be reduced to probably 5 per cent, which could easily be taken care of by a more judicious use of the other half of the fuel produced.

To improve the operating economy of a power plant is not a task that can be accomplished over night, however. Neither can gratifying results be obtained without first clearly defining the aims and plans for the improvement campaign or without the executives or operating officials securing the co-operation of the plant employees. The first thing to do is to place the equipment in first-class operating condition. Second, the maintenance work must be organized so that inspections and overhauling of apparatus will be conducted on a schedule frequent enough to forestall damage and prevent deterioration of efficiency.

The next step will be to investigate thoroughly each unit of equipment and determine by tests its maximum inherent efficiency. Inasmuch as the results are affected by the conditions under which they are obtained, the latter should be carefully noted. When this is done the study and test researches should be conducted on a larger scale in order to establish the relations of conditions governing the operation of individual units on the all-around total plant efficiency. Inasmuch as the final aim is not the highest thermodynamic efficiency but the best operating economy, the preceding findings should finally be modified in order to determine and standardize such conditions, supplies, methods, etc., as would necessarily produce the desired result. In determining the final aims the following aspects should not be lost sight of: Best service to the community, welfare of employees, safety of all concerned, and cost of operation, maintenance, idleness and standby losses.

When this part of the work is done, and not before, can the actual task setting for firemen, engineers, switchboard operators, etc., be considered, as it is evident that with poor upkeep of equipment, unstandardized supplies and methods the operating men cannot maintain the prescribed conditions.

Shifting Responsibility to Employee

Many easygoing owners and managers of plants, realizing that the actual performance is falling short of that possible, often shift the responsibility from their shoulders to those of the employee by offering a premium for performance which is sufficiently better than the present, leaving it to the employee to secure the "better results." In such cases the management sidesteps its duty in not saying *how* the better results can be accomplished and *what* they shall be. Such methods are sometimes advocated as giving the employee freedom to develop his ingenuity. This sophistry is easily exploded when it is considered that the operating man seldom has time for investigation and researches. His hands are full keeping the wheels turning. Furthermore, measuring and indicating instruments and devices are often lacking. The peculiar requirements of a research man—highly developed power of abstraction and observation, ability to concentrate on one problem to the exclusion of all others—are faculties which are seldom, if ever, found in men engaged in routine operating work.

Many Bonus Plans Unsatisfactory

It is generally conceded that higher efficiency warrants higher compensation and that stimulation for efficient work is necessary for its perpetuation. However, the lack of careful study of the subject is responsible for many misconceptions. Most of the methods of extra compensation are unsuitable, yet no better plan can be adopted unless the principles and operating conditions are properly organized. The faulty methods may be classified as follows: (a) Profit-sharing plans; (b) premium schemes, and (c) rewarding individual efforts.

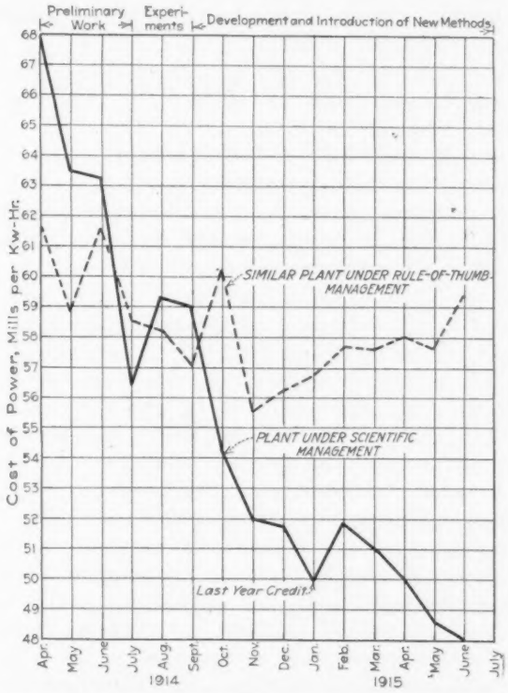
Profit Sharing.—Profit sharing is based on the assumption that the employees by their work contribute to the success of the enterprise in securing profits. This would be entirely correct if the employees had the opportunity to control all functions of management, fix the salaries of directors and direct purchases and sales, besides having a veto in financial transactions. As long as they are expected, however, to work under the conditions provided by the management, with equipment and material furnished by the management, which in turn disposes of the product, the profit or loss is only slightly influenced by the excellence of the work done by the men. If dividends are not declared, the workmen lose their share, perhaps through no fault of their own, since even if they have been working as hard as possible, blunders in policy and mismanagement will offset any good they have done.

Premium Plans.—Premium plans, as worked out in power plants, are very unsatisfactory. The common error of all the attempts in this line is that the final cost of operation is considered as a basis for the award or denial of the premiums. Yet it is perfectly clear that the cost depends not only on the excellence of work but equally, if not in a much larger degree, upon the method and means of upkeep, cost of fuel and supply and its quality, quantity of output, load factor, use factor, etc. None of these factors is under the control of the power-plant employee. Besides, the extent to which different employees contribute to the attainment of economical results is very unequal. While the firemen may effect as much as 50 per cent saving, the

switchboard operator cannot influence more than, say, 5 per cent, whereas the floor engineer can save or waste about 1.5 per cent at the most.

The unsuitability of the premium plan was forcefully demonstrated several years ago in a plant where employees who had been accustomed to earning premiums were unable to do so any longer owing to the use of poorer coal and a reduction in load.

Rewarding Individual Effort.—The rewarding of individual effort is perhaps the most unscientific scheme of all. The same objection exists that was cited before—the responsibility for securing better results is shifted onto men who have no authority to alter the conditions under which they are expected to produce results. The common error in applying the reward is to select arbitrarily one or more isolated factors, like CO_2 in flue gas, carbon in ashes, etc., and reward men


Preliminary Work
Experiments
Development and Introduction of New Methods
Cost of Power, Mills per Kw-Hr.
SIMILAR PLANT UNDER RULE-OF-THUMB MANAGEMENT
PLANT UNDER SCIENTIFIC MANAGEMENT
Last Year Credit
Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July
1914
1915

COMPARISON OF RESULTS SECURED IN PLANTS RUN BY RULE-OF-THUMB AND BY SCIENTIFIC METHODS

obtaining the best results. It is generally overlooked that any one or several of these factors do not indicate the true performance of the whole process. It is often wise to lose in one direction in order to gain more in the final result. Moreover, it is absurd to request men to secure better results without teaching them how to do it and without providing them with instruments showing the progress made.

If one of the advocates of these short cuts would take pains to investigate any of his hobbies—whether high CO_2, or low flue temperature, or good ashes, or anything else that can be produced—he would find that the relation of the factors is complex enough to warrant detailed study. Furthermore, good results cannot be expected unless the equipment used is maintained in first-class operating condition and the supplies furnished are the most suitable and of uniform quality.

A glaring example of inconsistency of the individual-reward plan is offered by the experiences of a Western railroad. Here it was recognized that the actual performance was worse than that possible, and that local conditions of various plants called for different standards.

The work of establishing standards of performance was based not on actual experiments but on average statistical data of the past, reduced by the guessed percentage suspected as waste. Then an allotment was made for each individual plant as to how much fuel should reasonably be consumed there per month. Similarly, pay rolls were revised and certain labor costs were assumed as reasonable. These two records multiplied by constants arbitrarily chosen (6 for fuel and 4 for labor) added together and divided by 10 gave the figure of merit used as a basis for the payment of bonus, the bonus itself being adjusted on a sliding scale.

The shortcomings of this crude method are apparent:

1. Men are left to discover for themselves how to secure the results desired by the management.

2. The management, shifting the responsibility to the men, was uncertain as to the exact amount of saving accomplished due to individual efforts, and therefore could not fix a definite bonus.

TASK-SETTING PLAN THAT BRINGS RESULTS

As opposed to all these methods, the writer advocates the assignment of a well-defined task to each member of an organization. The setting of a task presupposes the complete and detailed knowledge of each and every process performed in the plant and includes reliable information as to what each unit of equipment can do and what are the conditions producing the desired results. This knowledge, once gained through test and research work, is made available by instructions and training. Results necessarily follow conditions; therefore the task really consists in maintaining conditions as prescribed, not in attaining results, inasmuch as they are assured if all requirements are complied with.

To determine whether the men live up to their instructions, and consequently whether they earn their bonus, it is often convenient to judge by final results. However, these are not necessarily definite indications, since results may fall short of predetermination because of conditions beyond the control of the employee. To illustrate: Boiler efficiency may materially drop through no fault of the fireman if baffles and arches in the boilers are not maintained, owing to poor planning, lack of material, etc. Steam consumption may increase above what it should be if cool condensing water is not available. The man may fail to remove the ashes in the prescribed time if the locomotive batteries are not properly charged, the cleaning schedule disorganized, etc. It would be obviously wrong to deny the bonus to the employee who did all that was expected of him but who was unable to produce results through the fault of somebody else or something that could not be prevented by him.

Under such conditions an investigation should be made, not to verify the results, but to find out whether the conditions prescribed by the instruction card were lived up to. If they were, that is all that was expected from the employee and his bonus should be allowed him. This basic principle should apply in all cases. Favorable conditions may produce results slightly better than specified, yet they do not call for any additional reward since they evidently are not due to any extra work on the part of the employee. In other

words, the bonus remains constant as long as the terms of the instruction card are complied with, irrespective of whether the results are equal to, above or below a certain predetermined value. In case results are below a specified mark the bonus should be paid in full or not paid at all, depending on the investigation previously mentioned, but never should the bonus be reduced.

TABLE I—TWO TYPICAL REPORTS SHOWING INCREASE OF EFFICIENCY FROM ADOPTION OF METHODS OUTLINED IN TEXT

CASE I

	Representative Week 1917 (Nov. 17, 1917)	Corresponding Week 1916 (Nov. 18, 1916)
Total coal used, lb.	441,280	506,240
Coal equivalent in shavings, lb.	31,350	38,450
Total fuel used, lb.	472,630	544,690
Total water evaporated, lb.	4,901,170	4,625,250
Actual evaporation, lb. per hr.	10.37	8.51
Average steam pressure	58	56
Average feed temperature, deg. Fahr.	170	168
Factor of evaporation	1.073	1.075
Equivalent evaporation from and at 212 deg. Fahr., lb. per lb. coal.	11.12	9.15
Average B.t.u. per lb. coal.	14,800	13,550
Boiler efficiency, per cent.	72.9	65.6

CASE II

	Representative Week 1917 (Nov. 24, 1917)	Corresponding Week 1916 (Nov. 25, 1916)
Total coal used, lb.	452,480	526,400
Coal equivalent in shavings, lb.	29,700	40,350
Total fuel used, lb.	482,180	566,750
Total water evaporated, lb.	5,045,800	4,837,800
Actual evaporation., lb. per hr.	10.45	8.55
Average steam pressure	58	57
Average feed temperature, deg. Fahr.	163	176
Factor of evaporation	1.081	1.067
Equivalent evaporation from and at 212 deg. Fahr., lb. per lb. coal.	11.30	9.12
Average B.t.u. per lb. coal.	14,800	13,550
Boiler efficiency, per cent.	74.0	65.4

The knowledge of how to do things properly and the strongest desire to work according to the best methods are of no avail unless the conditions are such that it is possible to apply these qualifications. It is a well-known fact that the daily performance in a plant operating under old-fashioned management falls short of the results obtained during a specially arranged test. This is due chiefly to the failure to plan the work ahead and permanently maintain the conditions prevailing during the test.

In considering conditions which should be maintained to secure the best economy the elimination of causes producing fatigue should be given first rank, as in power-plant work neither the best of machinery nor excellent supplies can produce satisfactory results unless they are handled by men who are not tired, mentally or physically. From experiments conducted with firemen the writer has found that, other conditions being equal, a fireman on a twelve-hour watch is about 4.5 per cent less efficient than the same man on an eight-hour shift.

No one familiar with the common layout of a power plant can over-emphasize the importance of hygienic conditions to enable men to live up to their task day in and day out. While engine rooms not infrequently offer very pleasant and sanitary surroundings, boiler-houses, the most important part of any plant, are often so built as to make them unbearably cold in winter and uncomfortably hot during the summer. Good lighting is so unusual that after looking into the furnace a fireman can seldom read the gages or examine anything around the boiler. Good drinking water is rarely provided, and restful seats with backs (seats without backs are as bad as no seats at all) have never been found by the writer in any boiler house. If provided with seats having backs the firemen can clean the fires twice as rapidly as without them.

The absence of elementary conditions of comfort in a working place where the men spend the greater part of their lives is more harmful to the employers than to the employees. Petty annoyances and feelings of discomfort divert the attention of the men from the performance of their duties to means of avoiding the annoyance. Steady attention on the part of the firemen is much more important than is generally realized.

Of no less importance is the hygienic surrounding on the switchboard gallery. Flickering light from lamps on a low-frequency circuit, glare on the glass fronts of instruments, cement floors to walk on, inconveniently located telephones or telautographs, too low log desks, etc., are all excellent means to increase steam consumption per kilowatt-hour and reduce the safety to men, property and service.

It should be at least as much the duty of a management periodically to investigate and test the effect of surroundings on the attentiveness and physical fatigue of men as it is its duty to test coal deliveries and supervise the treatment which equipment receives. There are many ways to ascertain the degree and the character of fatigue, but reference thereto will not be made here for lack of space. Whatever the methods may be, they should be applied at regular intervals to each and every employee, and their individual health-record cards should be kept, using some convenient rating to watch easily the decline or gain of vitality of each man. Should the decline be noticed, measures should be taken at once to find out the cause. If it is of individual nature, good advice or doctor's services should be offered. If it affects a group, the harmful condition must be eliminated as rapidly as possible. Little alterations that are usually required to remove harmful conditions are a great deal cheaper (not to say humane) than breaking in and training a new employee, or even a temporary substitute.

To conclude this rather condensed outline of the principles advocated by the writer, it might be of interest briefly to review a few typical cases where this mode of management has been adopted.

TABLE II—IMPROVEMENT IN PENNSYLVANIA PLANT BY SETTING TASK WORK AND GIVING BONUSES

BOILER ROOM			
Coal used (banking excluded), lb.	48,800	49,200	34,000
Water evaporated, lb.	419,800	408,200	284,000
Actual evaporation, lb. per hr.	8.62	8.32	8.37
Factor of evaporation	1.2187	1.2185	1.2287
Equivalent evaporation, lb. per lb. coal.	10.50	10.13	19.28
Efficiency of generation, per cent.	73.4	70.8	71.3
Cost of fuel per 1000 lb. of steam, dollars	0.0815	0.0845	0.0833
ENGINE ROOM			
Hydroelectric output, kw.-hr.	980	850	30
Steam generated output, kw.-hr.	21,220	20,450	15,070
Load factor, per cent.	79.5	64.4	67.5
Steam per kilowatt-hour, lb.	19.78	20.00	18.85
Coal per kilowatt-hour, lb.	2.30	2.40	2.26
Thermal efficiency of plant, per cent.	10.71	10.27	10.73
Cost of fuel per kilowatt-hour (banking included), dollars	0.00201	0.00204	0.00200

Several years ago the writer was asked to specify additional boiler equipment in a plant containing ten

Manning boilers equipped with Jones underfeed stokers. To-day the old plant satisfies the 30 per cent increased demand, using only seven of the old boilers, and the efficiency, which had been slightly below 50 per cent, is now about 73 per cent. No investment of any kind for generating equipment was made, but about $2,000 worth of instruments was provided, which yields 400 per cent interest. After the instruments were provided and the efficiency raised from 50 to 65 per cent by stopping various leaks, further progress was made by training employees in maintaining high boiler efficiency.

In a Pennsylvania public utility company, where the average efficiency as established by an eighty-day observation of hand-fired Edge-Moor boilers was 54 per cent, without any expense for replacement of generating equipment and with only a few additional instruments, the writer's methods, comprising the task work with bonus, improved the average daily performance, as exemplified in Table II, about 33 per cent.

The adoption of the same principles in a 32,000-kw. central station, even without paying bonuses, resulted in the improvement of operating economy as represented graphically on page 37, showing how operating cost was reduced about 30 per cent. The dotted line on the chart represents the result of operation of a competing plant in similar service in the same time.

There is hardly any use in multiplying examples, all of which tend to show what opportunities exist for a management which undertakes to carry out the work on the basis of facts and not in accordance with old customs and habits. The greatest industry of this era of power and electricity can thus be carried out in a manner creditable to the engineer and beneficial to the community.

Adapting Existing Lines to Increased Loads

New Outdoor Substation Was Built with Equipment That Was Taken from Other Stations—Practicable Method of Reinsulating 45 Miles of Line While Alive—A 26-Mile Line Loss Eliminated

BY E. B. HOOK, JR.

Superintendent Construction Georgia Railway & Power Company, Atlanta, Ga.

FACING unprecedented demands for electric power, due primarily to the many new industrial plants being built, as well as old plants and municipalities shutting down their steam stations in the neighborhood of Atlanta, the Georgia Railway & Power Company has been exerting every effort to extend its lines and provide distribution facilities so as to serve the loads thrust upon it. In view of the great shortage of material and labor this task is not only difficult but expensive. Means for giving continuous service as well as for rearranging equipment and lines necessarily had to be evolved along the most economic lines. One interesting improvement in service which was accomplished at low cost and in a short time without interruption to service is described in detail here.

Owing to a heavy increase in load caused by one of its large cotton-mill customers near the end (Covington) of a 60-mile (96.6-km.) 22,000-volt wooden-pole line, it was found necessary to raise the line potential to 38,000 volts. The work of raising the voltage on 60 miles of line was quite a job in itself, but in addition considerable preliminary work was necessary in order to prepare for the change. The line in question is the Atlanta-Stone Mountain-Monroe transmission line, originally energized through the Boulevard substation in Atlanta from the Dunlap water-power plant near Gainesville, energy being transmitted over the Boulevard-Gainesville transmission line.

In order to reduce line losses and increase the efficiency of the Stone Mountain line a 6000-kva. outdoor-type transformer station was built at Norcross, Ga. This station has two 110,000-volt incoming feeder lines from Tallulah Falls and two banks of four 1000-kva., 110,000/38,000-volt transformers connected delta-star. One unit of each bank is a spare. One operator can control the station automatically from a benchboard in-

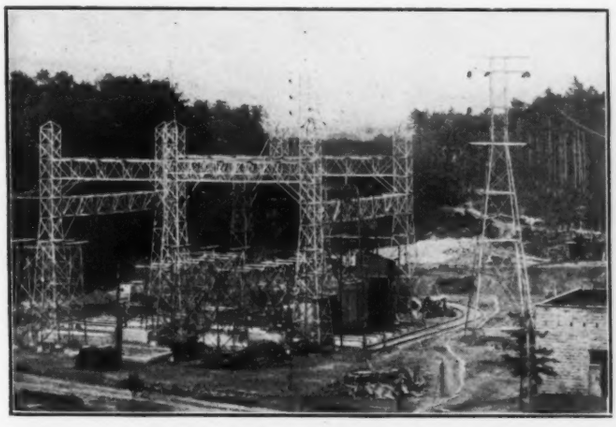


FIG. 1—OUTDOOR SUBSTATION UNDER CONSTRUCTION

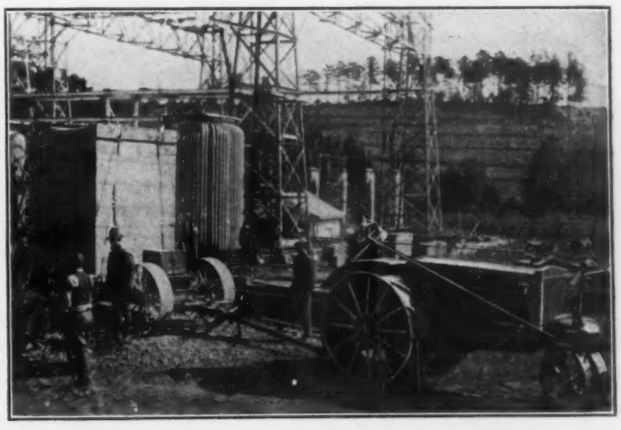


FIG. 2—METHOD OF HAULING TRANSFORMERS TO STATION

stalled in a neat brick operating house. Either bank of transformers can be energized from either high-voltage line at will and the load automatically transferred to the bank doing duty.

Owing to the difficulty of obtaining equipment immediately from manufacturers and also to minimize the investment, the system was searched for apparatus that could be spared without causing unnecessary inconvenience. Consequently the apparatus installed at the new Norcross station was collected from various less important points over the system, the steel-frame structure being one that was dismantled and shipped from Fairburn. A standard No. 2/0 transmission tower was erected in its place. Three of the transformers were moved from Cartersville, three from Marietta and two from Lindale. The dismantling, crating, shipping and installing of these 1000-kva., 110,000-volt transformers was a small-sized job, as each unit weighs over 20 tons and holds 3000 gal. (11,356 l.) of oil. It was necessary before placing them back into service, after shipping, to dry each core and filter the oil just as if the transformers had been assembled new from the factory.

Construction of Transmission Lines

From Norcross to Stone Mountain, a distance of 10 miles (16.1 km.), a 38,000-volt transmission line was built on 50-ft. (15.2-m.) creosoted poles. This line being energized at the Norcross station will feed the Atlanta-Monroe line at Stone Mountain, thereby cutting off the Atlanta end of the load and 26 miles (41.8 km.) from the length of the line. The line conductors are No. 2/0 stranded, bare hard-drawn copper, arranged triangularly, 5 ft. (1.5 m.) between wires. A special wood-pin bracket is securely bolted to the top of the pole for one conductor and a heavy treated wood cross-arm attached 50 in. (127 cm.) down the pole for the other two. A private telephone line is strung on the same poles 3 ft. (0.9 m.) below the heavy arm.

The Stone Mountain-Monroe transmission line, the voltage of which had to be raised, was originally constructed in 1913 for 22,000 volts working pressure. It is on 40-ft. (12.2-m.) chestnut poles and about 45 miles (72.4 km.) long. The line conductors, which are 2/0 hard-drawn stranded-copper cable, are strung on 4-in. by 6-in. by 8-ft. (10.2-cm. by 15.2-cm. by 2.4-m.) creosoted cross-arms—two wires on one side of the pole and one on the other. The cross-arm is bolted 3 ft. (0.9 m.) below the roof of the pole and a ¼-in. (1.6-cm.) copper-clad steel ground wire is strung above the conductors and fastened to the top of each pole. The private telephone line, which is 30 in. (76 cm.) below the conductors, on standard 2-pin cross-arms, is transposed every fourth pole.

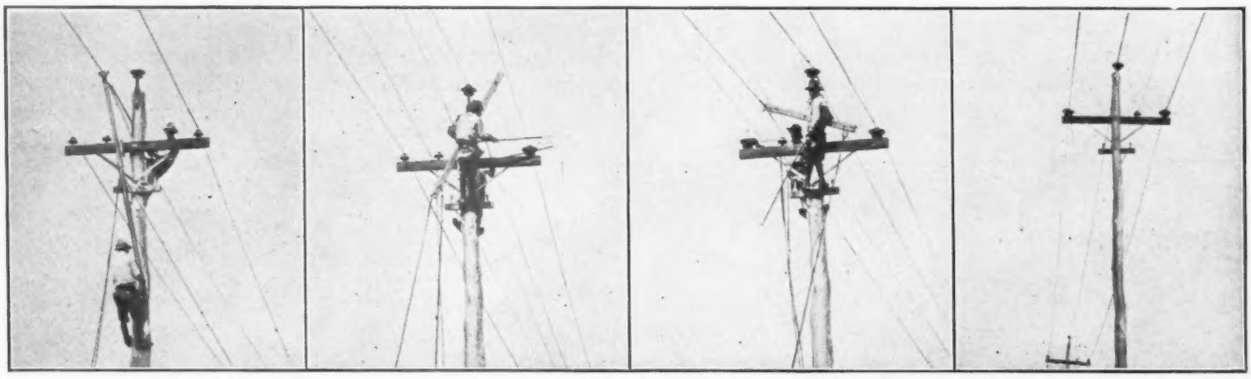
To raise the voltage of this line it was necessary to completely reinsulate the line, to increase the conductor spacing, to remove the overhead ground wire and to refrain from causing an interruption of even one minute to any of the numerous customers along the entire line. A moment's reflection will reveal the magnitude of this apparently impossible problem, but it was done with a crew of twelve comparatively inexperienced men, four linemen, six ground men, a cook and a foreman, in five months' time.

Method of Changing Line While Alive

The first step was the removal of the overhead ground wire, which was taken loose from the pole tops and laid down on the power arms, close to the pole on the side on which there was only one conductor. The ground wire was then cut in sections of about ¼ mile (0.4 km.) lengths and pulled off ahead. A tail line was used to hold the free end taut to keep it from whipping into the live wires. Next a specially designed wooden bracket was bolted to the top of each pole with two ⅝-in. (1.6-cm.) machine bolts. The top of this bracket extends some 8 in. (20.3 cm.) over the roof of the pole. An insulator was screwed on this bracket by hand and the middle leg of the flat-spaced line raised thereto, giving an equilateral spacing of 60 in. (152.4 cm.) between conductors (Fig. 3).

This move was accomplished by means of a 10-ft. (3-m.) insulated lifting pole, 3 in. (7.6 cm.) in diameter, fastened to the cross-arm by a pivoted collar. The top of the pole is provided with a socket and safety locking jaws for holding the conductor. The pivoted collar which holds the pole to the cross-arm forms a sliding fit around the pole, so that by means of a small set of blocks and tackle a man on the ground can raise or lower the pole at the command of the lineman above, who guides the conductor into its proper position (Fig. 4).

The tie wire was wrapped around the neck of the insulator before it was screwed on the pole-top pin, a small loop left in each end, and the free ends were bent out so that the conductor could be placed directly in the insulator grooves. By means of a small prong on the end of 8-ft. (2.4-m.) switch sticks the lineman wrapped this tie wire around the line conductor (Fig.



FIGS. 3, 4, 5 AND 6—STEPS IN CHANGING FROM HORIZONTALLY ARRANGED CONDUCTORS TO TRIANGULAR SPACING TO PERMIT HIGHER VOLTAGE OPERATION

5). With a surprisingly small amount of practice the linemen were able to tie in the hot conductor as securely as they could a dead line with a pair of pliers.

The next step was to raise the outside wires off their insulators while higher voltage units were substituted. This was done with the same apparatus, the tie wires being removed by means of a switch stick with prongs, which were filed flat to resemble the end of a screw-driver. As the tie wire was unwrapped from the conductor the free ends were sawed off every few inches with a hack-saw mounted on the end of a switch stick, which is a safety measure to prevent the possibility of the ends of the tie wire coming in contact with the cross-arm or braces as it is unwrapped. After the tie wire was removed the groundman pulled the fall line connected with the lifting pole, thus elevating the conductor and allowing the lineman to unscrew the

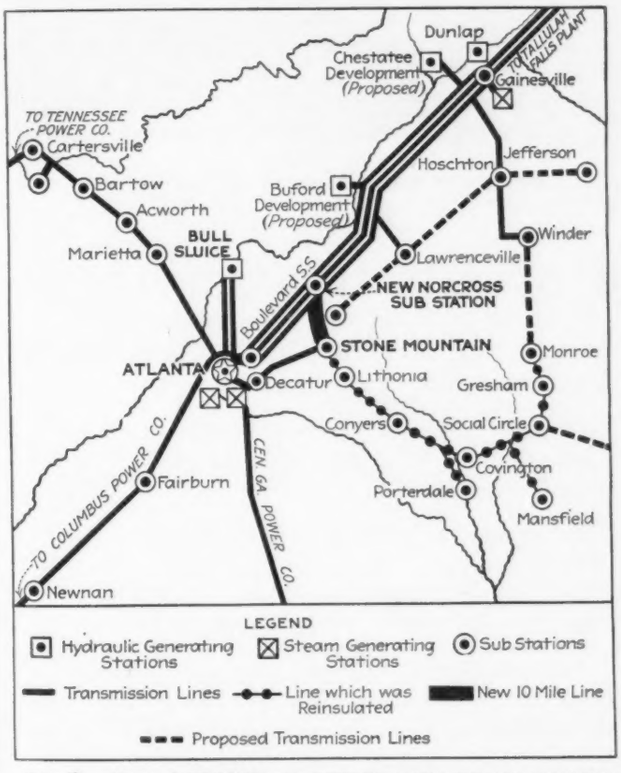


FIG. 7—MAP OF SECTION OF SYSTEM INVOLVED BY CHANGE

old insulator and substitute a new, higher-voltage unit equipped with a tie wire. The conductor was then lowered and tied in as outlined before. The lifting pole was then shifted to the other end of the cross-arm and the third conductor changed in a similar manner.

While making these line changes one of the linemen noticed that a large proportion of his time was consumed in changing the position of the lifting pole, so he obtained a dry piece of 2-in. by 4-in. (5.1-cm. by 10.2-cm.) timber 6 ft. (1.5 m.) long, shellacked it carefully and cut a 2-in. (5.1-cm.) notch in each end. After raising the middle conductor and tying it on the pole-top pin, he lowered the lifting pole to the ground, suspended the treated timber at its middle from a collar around the pole, fitted one notched end over one of the outside conductors, and had the ground man raise the conductor the required distance by pulling on a hand line fastened to the other end of the timber. To change the third insulator the hand line was snapped on the opposite end of the timber and the process reversed. The old line insulators were used to reinsulate the telephone line..

It is interesting to note that when the crew began the work of increasing the insulation on this line the foreman was the only man that had ever seen the lifting pole in service or an insulator changed on a live line. Nevertheless, the crew changed six complete poles the first day. In a week they were changing fifteen, and after the first month's work they averaged thirty-five to forty poles, a little better than one mile (1.6 km.) per day.

Diminishing Eddy Currents

Prof. Allan B. Field, in patent No. 1,241,503, has devised a method for annulling the excessive heating occurring in the ventilating spaces of turbo-generators.

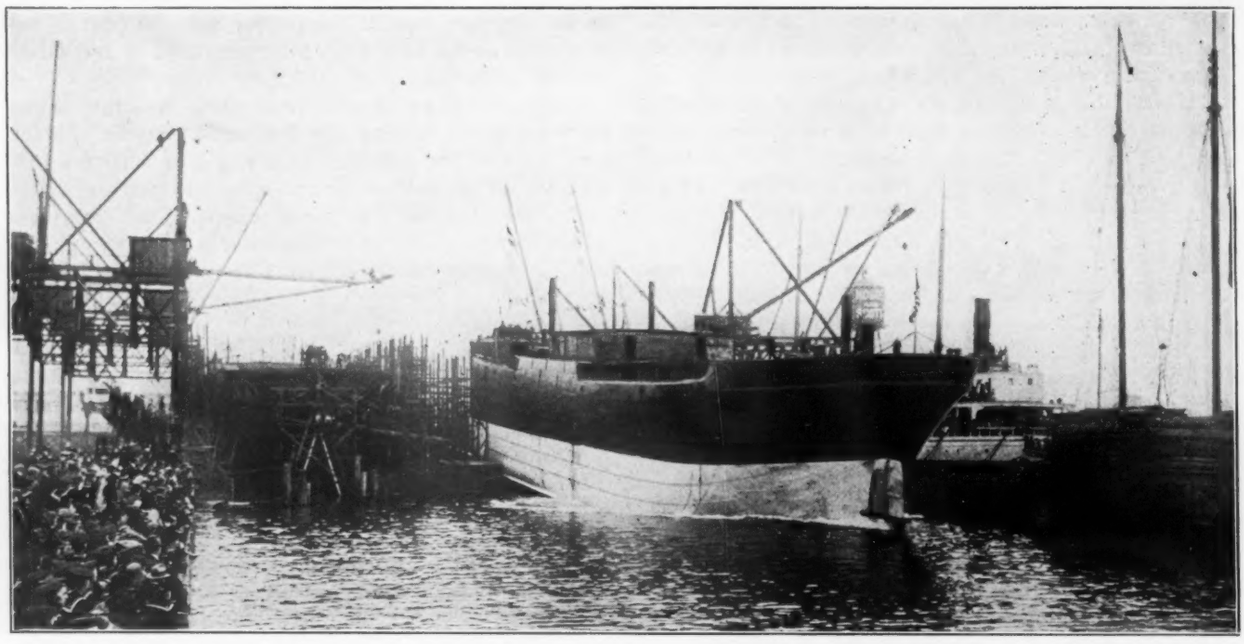
By the invention an annular laminated ring of magnetizable material is disposed in the annular vent space for the purpose of concentrating a greater portion of the magnetic lines of force entering the vent space and diverting the path in a direction parallel to that of the lines of force traversing the field magnet and magnetizable core members. This arrangement prevents to a large extent the fringing of the magnetic lines of force into the sides of the vent space, with the resulting circulation of eddy currents. As an additional aid toward the accomplishment of the same result, a series of introgressively stepped portions of the core on each side of the vent space is also provided.

Dynamo Brushes with Phenol Resin as Binder

J. Ernest Thomsen of Jersey City, N. J., in patent No. 1,245,009, assigned to the Dixon Crucible Company, suggests the use of the new phenol resin compounds as a binder for carbon brushes for dynamo use. In producing the brushes finely divided carbon is mixed with a phenol or creosol or a compound or mixture containing phenols and creosols, such as pitch, tar or creosote oil, and formaldehyde or a formaldehyde derivative and hexamethylenetetramin. It is preferable not to have the carbon content of the mixture reduced to a uniform degree of fineness. It should preferably consist of particles of graphite of different sizes. If formaldehyde is used, then it is desirable also to add a small quantity of alkali, as, for example, ammonia, to the mixture.

The strength of the final material as well as its electrical conductivity may be varied by varying the proportion of the carbon to the other ingredients in the mixture. One formula found to give a very satisfactory product is as follows: 64 per cent carbon (containing particles of different sizes), 8 per cent of coal tar, 15 per cent creosote, 3 per cent hexamethylenetetramin. This mixture is then heated to a temperature not exceeding 450 deg. Fahr. (232.2 deg. C.) to drive off the volatile matter, and the remaining mass is ground to a powder.

The powder thus formed is then pressed into molds at a pressure which must vary according to the hardness and density desired in the product. When making the electrode for use as a motor brush, a pressure of 2 tons per square inch (281 kg. per sq. cm.) is satisfactory.



SHIPS, SHIPS, AND MORE SHIPS ARE NEEDED. MORE THAN A BILLION DOLLARS IS BEING SPENT TO BUILD THEM, AND ELECTRICITY IS GIVING INVALUABLE AID

Shipbuilding Expedited by Electric Service

Study of the Power Requirements and Description of the Electrical Distributing System for Staten Island Shipbuilding Company, Mariners' Harbor, Staten Island, N. Y.

BY DAVID ELWELL
Lockwood, Greene & Company, Engineers

WHEN the demand for ocean tonnage became pressing about a year and a half ago the Staten Island Shipbuilding Company found itself with a large tonnage of steel vessels contracted for and merely the beginnings of a modern yard in hand in which to build them. It was therefore necessary to provide for the completion of the yard and for an adequate supply of power. A thorough study of the best way of meeting the power requirements was therefore undertaken by the company's engineers, Lockwood, Greene & Company. An outline of this study, with the conclusions reached, is given in what follows.

The whole development comprises not only a complete engine, hull and boiler plant, but includes facilities for every variety of marine repair work, duplicating in the latter respect the company's older plant at Port Richmond. In passing it may be mentioned that this latter yard is operated from a producer-gas power plant containing 220-volt direct-current engine-type generators directly driven by gas engines designed and built by the Staten Island Shipbuilding Company.

The fact that ship repairs are made at the new yard increases the demand for compressed air beyond that required for new vessels and gives rise to a considerable use of steam. This is used for running auxiliaries, where necessary, on vessels under repair and for heating them in winter. A supply of power in addition to that required in a shipbuilding plant only is that used electrically for the operation of floating dry docks for hull repairs.

The power requirements are therefore classified as follows:

KIND OF POWER	PURPOSE
(1) Electricity:	(a) Lighting
	(b) General motive power
	(c) Dry-dock operation
	(d) Air compressors if electrically driven
(2) Steam:	(a) Heating
	(b) General use around the yard and on ships undergoing repairs
(3) Compressed Air:	(a) Pneumatic tools
	(b) General yard use

The foundry and pattern shop and storage buildings are about one-third of a mile (5.3 km.) back from the shipyard proper. A low-pressure steam-heating plant was installed there with indirect heating by air circulation for the foundry and direct radiation elsewhere. Alternating-current energy from the lines of the Richmond Light & Railroad Company was at hand when these buildings were completed and was therefore used for woodworking machinery in the pattern shop and for cranes, cupola blowers, etc., in the foundry.

The power load of the foundry being of a limited amount, the heating was preferably handled by a local boiler, as steam pipes from a main boiler plant at the shipyard would have had to traverse public streets for quite a distance. The demand for steam and electric

power here was not enough to have a definite influence on the power calculations in the shipyard. The main yard had a 220-volt direct-current power plant, but being entirely inadequate and in a location needed for other purposes in the new development its use could not be considered.

POWER REQUIREMENTS AND RELATION OF DEMANDS

Studies were made to determine the amount of power required for the various purposes mentioned, the kind and relation of the different demands and load curves.

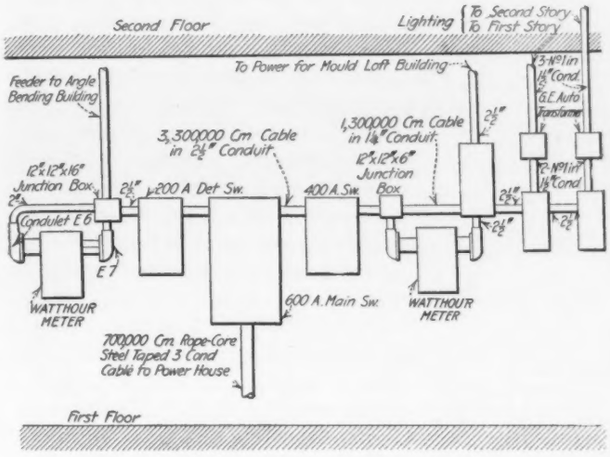


FIG. 1—ARRANGEMENT OF METERING AND SWITCHING EQUIPMENT IN MOLD LOFT

Regarding the lighting requirements, eighteen different buildings (excluding the foundry group) had a demand of 60 kw. For motive power in the buildings, exclusive of compressors, cranes and direct-current requirements, it was found that the average requirement would be 420 kw., with a 500-kw. maximum.

For the three floating dry docks a maximum demand of 500 kw. was computed, with two docks in simultaneous operation, although the annual consumption is only 150,000-kw.-hr. approximately. The actual pumping period varies from one-half to one and one-half hours, according to the size of dock, and the annual power consumption is based on 100 hauls per year and an equal number of pumping periods for setting the keel blocks. For the operation of air compressors, if electrically driven, it would be necessary to have 250 kw. for each of two compressors and 500 kw. for a larger unit, making a total of 1000 kw. This represents a total capacity of about 7000 cu. ft. of air per minute (198.2 cu. m. per second).

On account of the exacting service required of cranes, particularly in the boiler shop and in the machine shop for assembly of engines, etc., and to secure the benefits of dynamic braking, direct-current cranes were preferred to alternating-current cranes. A considerable demand for direct-current energy arose from various adjustable-speed drives in the shops, on machine tools and the electric winches for handling steel at the shipways. This direct-current requirement constituted another item of electric power to be taken into account, running about 300 kw.

Regarding the steam requirements, it was found that 12,000 lb. (5443 kg.) of steam per hour at 2 lb. to 5 lb. (140.6 g. to 351.5 g.) pressure was the maximum necessary for heating, some buildings requiring heat in whole or part and at temperatures of 50 deg. to 70 deg. Fahr. (10 to 21.1 deg. C.), according to occupancy. High-pressure steam requirements for general use in the yard and for live-steam lines to vessels under repair for driving auxiliaries and heating ranged from a minimum of 75 hp. to a maximum of 400 hp., according to conditions.

All reasonable methods of running the plant were assembled as follows for study:

I. 1. High-pressure condensing turbines for power, lighting and dock pumping.
2. High-pressure steam-driven air compressors, (a) non-condensing, (b) condensing.

II. 1. High-pressure non-condensing air compressors.
2. Mixed-pressure turbines for power, lighting and dock pumping.

III. High-pressure condensing turbines for power, lighting, dock pumping and air-compressors—motor-driven.

IV. 1. Purchased electric power for lighting, power and dock pumping.
2. Steam-driven air compressors, (a) condensing, (b) non-condensing.

V. Purchased electric power for lighting, power, dock pumping and air compressors.

Under scheme I it was found that any steam saved by condensing operation of compressors was offset by that required for condenser drive and by the live steam which was required for heating in lieu of the exhaust otherwise available, not to mention the added investment.

With scheme II it was found that the compressors at full load would not pass enough steam to mixed-pressure turbines to meet the demand for shop power, even excluding lighting and dry-dock operation. Consequently high-pressure make-up would always be required for the mixed-pressure turbines, with very large amounts at times of small compressed-air demand. Moreover, the compressor exhaust was just about the amount needed for feed water and building heating, so that a good part of the time the turbines would be running at very poor economy mostly on high-pressure steam. With little or no coal saving from this scheme and an added investment to cover it if adopted, increased complication and diminished reliability, a power plant based on scheme II was definitely abandoned.

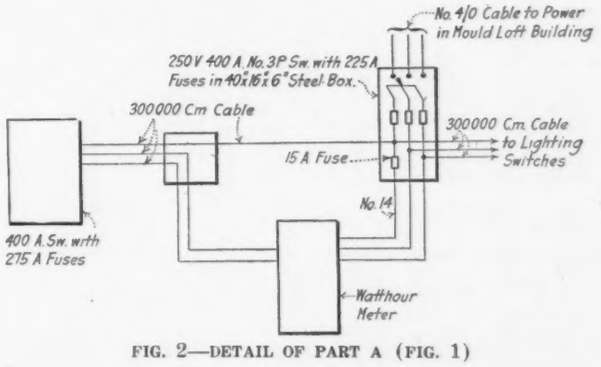

No. 4/0 Cable to Power in Mould Loft Building
250 V 400 A. No. 3P Sw. with 225 A. Fuses in 40"x16"x6" Steel Box.
300000 Cm Cable
300000 Cm. Cable to Lighting Switches
15 A. Fuse
No. 14
400 A. Sw. with 275 A. Fuses
Watthour Meter

FIG. 2—DETAIL OF PART A (FIG. 1)

Scheme III involved increasing the turbine capacity to handle motor-driven air compressors. While the turbines would utilize the steam more efficiently than air compressors, the electrical losses of the latter, if motor-driven, would leave only a slight theoretical saving in this scheme over scheme I. This difference might disappear in actual operation, and the disadvantage of

having the compressors dependent on the turbine in this arrangement again gave scheme I the advantage.

Purchased electric power being in use at the foundry, its possible use for the whole plant was investigated. The central station serving this district is that of the Richmond Light & Railroad Company at Livingston, S. I., 3 or 4 miles from the Mariners' Harbor yard. It is a condensing station on tidewater, of 16,000 kva. total generating capacity, and has been quite thoroughly modernized in the last year or two. This capacity is made up of a number of up-to-date turbine units, and as the management announced its policy to maintain a generating capacity of 100 per cent above the highest peak and was negotiating for an additional turbine of 10,000 kva., it was felt that the station furnished a reliable source of electrical energy.

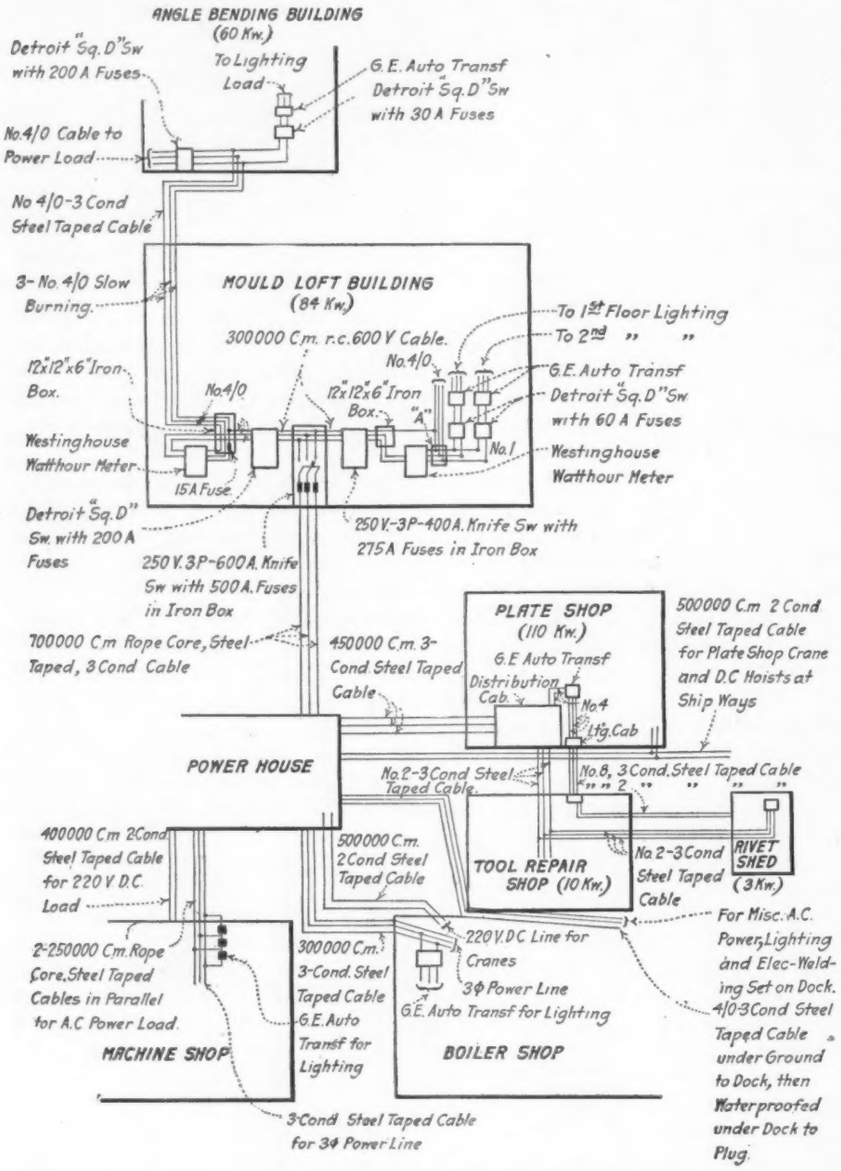

ANGLE BENDING BUILDING (60 Kw.)
Detroit "Sq. D" Sw with 200 A Fuses
To Lighting Load
G.E. Auto Transf Detroit "Sq. D" Sw with 30 A Fuses
No. 4/0 Cable to Power Load
No 4/0-3 Cond Steel Taped Cable
3-No. 4/0 Slow Burning
MOULD LOFT BUILDING (84 Kw.)
300000 C.m. r.c. 600 V Cable.
To 1st Floor Lighting
To 2nd " "
No. 4/0
G.E. Auto Transf Detroit "Sq. D" Sw with 60 A Fuses
12"x12"x6" Iron Box.
No. 4/0
12"x12"x6" Iron Box "A"
No. 1
Westinghouse Watthour Meter
15 A Fuse
Detroit "Sq. D" Sw. with 200 A Fuses
250 V.-3P-400 A. Knife Sw with 275 A Fuses in Iron Box
250 V. 3P-600 A. Knife Sw with 500 A. Fuses in Iron Box
700000 C.m Rope Core, Steel Taped, 3 Cond Cable
450000 C.m. 3-Cond. Steel Taped Cable
PLATE SHOP (110 Kw.)
G.E Auto Transf
Distribution Cab.
No. 4 Ltg. Cab
500000 C.m 2 Cond Steel Taped Cable for Plate Shop Crane and D.C Hoists at Ship Ways
POWER HOUSE
No. 2-3 Cond Steel Taped Cable
No. 8, 3 Cond. Steel Taped Cable
" " 2 " " " "
400000 C.m 2 Cond Steel Taped Cable for 220 V D.C. Load
500000 C.m. 2 Cond Steel Taped Cable
TOOL REPAIR SHOP (10 Kw.)
No. 2-3 Cond Steel Taped Cable
RIVET SHED (3 Kw.)
For Misc. A.C. Power, Lighting and Elec-Welding Set on Dock.
2-250000 C.m. Rope Core, Steel Taped Cables in Parallel for A.C Power Load.
300000 C.m. 3-Cond. Steel Taped Cable G.E. Auto Transf for Lighting
220 V.D.C Line for Cranes
3φ Power Line
G.E. Auto Transf for Lighting
4/0-3 Cond Steel Taped Cable under Ground to Dock, then Waterproofed under Dock to Plug.
MACHINE SHOP
BOILER SHOP
3 Cond. Steel Taped Cable for 3φ Power Line

FIG. 3—LAYOUT OF DISTRIBUTION SYSTEM SERVING STATEN ISLAND SHIPBUILDING COMPANY

The power company's existing 2300-volt lines in the neighborhood of the shipyard were practically fully loaded, but as they had under construction duplicate three-phase, 60-cycle, 6600-volt lines through this district for other power business, it was certain that a reliable supply of central energy could be delivered at the yard if it proved to the company's advantage to use it.

With scheme IV the exhaust from the steam-driven air compressors would be used for feed water and building heating, while with scheme V a boiler plant would be used for direct steam requirements only. Comparing these two schemes involving central-station service, it developed that the total annual plant costs under scheme V would be theoretically $5,000 per year more than under scheme IV. The smaller capital investment under the former scheme would partly cover this and the reduction in the size and complexity of the power plant made scheme V the favored one.

With scheme V preferred to scheme IV and scheme I superior to scheme II or scheme III, the final choice for plant power supply was between scheme I and scheme V. Scheme I involved some $100,000 higher capital investment than scheme V, although total power costs per year figured about $9,000 less than for scheme V. Fixed charges against such a plant were taken as 12 per cent. Considering present high interest rates, a higher figure than 12 per cent is probably warranted. One other aspect of the item of fixed charges is that in any undertaking involving the use of capital (if, for example, the investment is made on borrowed money at a nominal rate, included in the 12 per cent fixed charges), if any net profit is to return to the owners, the fixed charges must be taken sufficiently in excess of this percentage to cover the profit expected. From this point of view a fixed charge of 16 per cent would reduce the total annual difference in cost between scheme I and scheme V to nominally $5,000.

A number of other considerations aside from the strictly financial ones arose in making the final decision. A large plant for the private production of all power would occupy considerable valuable space in the yard. Deliveries on power-plant equipment were long and many months would elapse before a suitable power house could be finished and put into service. The construction of such a plant would take time and energy from other parts of the development where needed and be one thing more demanding continuous attention if built. On the other hand, the space required for power purposes with central station service would not be an important item. Purchased electric power was instantly available and involved no wait for prime movers, relieving the plant from itself having to make an indispensable commodity.

As a result of these considerations it was decided to purchase electric power for yard requirements on the basis of scheme V, retaining the existing boiler plant for the steam service noted, and a contract was accord-

ingly signed with the Richmond Light & Railroad Company.

Energy for the plant is taken from the electric-service company's aerial lines at a point near the purchasers' substation, which is situated at about the middle of the yard. The energy is measured by an outdoor meter installation. The line splits, one branch running up to the foundry on the power company's street pole line, while the other branch runs underground into the substation.

The essential questions arising in connection with the utilization of the electric power were the method of distribution to be adopted for power and lighting and the voltage to be used. The owners wanted to avoid any personal hazard to operatives even at considerably increased distribution cost by using as low a voltage as practicable. A motor voltage of 220 volts was accordingly adopted. In the substation there was no need of going to such a low voltage, as only the operating force would have access to the premises, therefore 440 volts was selected for serving the direct-connected synchronous motors on the air compressors.

THE LIGHTING SYSTEM

For lighting it was not desired to carry the supply voltage to the various buildings nor was it desirable to run individual low-voltage lighting lines to the different buildings. It was therefore decided to have a single alternating-current three-phase feeder for each building or group of buildings and to split one phase with a 220/110-volt balancing coil to get the desired lighting voltage. Where the lighting load would have been sufficient to cause serious unbalance on the three-phase supply, the load was distributed around the phases, each phase having its own auto transformer.

This arrangement eliminated considerable expense which otherwise would have been involved in purchasing high-voltage transformers for lighting. It increases only slightly the size of the power distributing lines and eliminates the hazard of high-voltage distribution around the yard for lighting.

Aerial distributing lines with the low-voltage employed would have been unsightly on account of their size, and the wires and poles would have interfered continually with the locomotive cranes in the yard. It was therefore decided to run the wires underground. Running underground lines in this yard involved some special considerations. The ground in the yard is largely filled with ashes and cinders and is not much above tide level. This meant that it would always be soft and wet, so that it would have been almost impossible to find a solid bottom on which to rest clay or fiber duct lines incased in concrete. Under such conditions the ducts would surely have settled and caused trouble, especially with the passage of cranes and trucks above. Furthermore, it would have been necessary to waterproof all manholes because of excessive water, and on account of the low elevation of the land with respect to the tide drainage of them would have been practically impossible. Since the yard is well filled with various structures, such as plate racks, tracks for cranes, etc., the installation of concrete-duct lines would have been very difficult. The use of steel-armored lead cable eliminated all the difficulties which the other scheme would have brought up, and it was accordingly adopted.

The substation, which is employed to house the main transformers, distributing switchboard, motor-generator sets and air compressors, is a brick and steel building and contains a traveling crane. The incoming underground service passes through a cell-mounted switch on the street end of the building and thence to the transformers. These have split secondary windings giving a full voltage of 480, which is used for the compressors. The 240-volt, three-phase circuit for the general shop motors is connected with the mid-point of secondary winding of each transformer.

Twelve feet (3.6 m.) from the street end a wire grille runs across the entire substation, with a door at each wall. This fences off the power transformers and forms a back support for the switchboard tie rods. The 240-volt and 480-volt leads from the transformers join their respective busbars on the board which is erected in front of a cable trench running parallel to the grille. A cable trench runs entirely across the power house, carrying the outgoing lines from the switchboard out through the building wall in each direction underground. A similar cable trench running lengthwise of the building, connecting with the transverse trench at the switchboard, carries the circuits to and from the synchronous motors on the air compressors, their exciters, the alternating-current, direct-current, motor-generator sets, etc.

For the outgoing underground circuits the armored cable rises from the trench directly to the switch terminals. The circuits for power-house apparatus are run in rigid iron conduit in the trenches. The trenches are provided with flush-checkered, steel-plate covers in removable sections. Automatic oil switches with transformer trip and inverse-time-element relays are mounted directly on the panels, and manually operated for the alternating-current circuits. Knife switches and carbon-break circuit breakers are used for the 220-volt, direct-current circuits.

The switchboard, except for the air-compressor panels, was furnished by the Westinghouse Electric & Manufacturing Company. The synchronous motors, their exciters and switchboard panels, were furnished by the General Electric Company. The board has been equipped as simply as possible to meet the requirements. Ammeters are provided to indicate load on each power-house circuit and outgoing line. By means of ammeter switches the current in any phase may be obtained, these readings being necessary, as the phases may be slightly unbalanced by the auto-transformers for lighting.

For purposes of cost recording the energy required for each building or group of buildings engaged in an individual manufacturing process is measured by a watthour meter on each feeder. In certain cases—that of the mold loft and the plate and angle-bending building, for instance—the load is light enough for a single feeder, so the segregated power for each building is obtained by watt-hour meters in the mold loft where the feeder splits.

The essential ideas which have been followed in connection with buildings and equipment are simplicity, ruggedness and thorough adaptability for the service required. These facts, together with the speed attained on the work, have enabled the owners already to deliver complete steel cargo vessels, now in service on the seas.

Effective Work of Associated Manufacturers

The Thorough Organization by Sections That Has Been Accomplished by Makers of Electrical Supplies Found to Be of Immediate Value for War Service of the Nation

THE Associated Manufacturers of Electrical Supplies has followed consistently the lines laid down early in the active career of this influential body. From the beginning the purpose has been to create an organization of intensely practical value to members. It was desired to form a medium through which the manufacturers might co-operate to the best advantage in developing trade relations both broad in scope and with sufficient definite direction to prove of permanent value. This medium, highly developed to a point where it is of great and permanent usefulness to members, has become a factor of great and powerful value to the government in the mobilization of industries for war.

In organizing itself more closely the manufacturing branch of the electrical industry is following the trend of developments in other branches. Among the manufacturers organization is now complete through the Associated Manufacturers of Electrical Supplies, embracing all the many and varied lines of electrical supplies; the Electrical Manufacturers' Club, an agency for bringing the executive officials together twice a year to discuss questions of policy, and the Electric Power Club, an effective established organization of manufacturers of motors, transformers and control apparatus. There is no conflict whatever between either the purposes or the actual work of these different bodies.

As is generally known, each of the three organizations has four representatives who meet in the Electrical Manufacturers' Council, providing an effective means for co-ordinating the work of the individual organizations, so that it may be unified on questions of common interest, while leaving each separate organization with a clearly recognized sphere of operation free to do special work in its own field.

The most distinctive characteristic in the organization of the Associated Manufacturers of Electrical Supplies is the extensive and intensive development through its sections. In effect, the sections carry to different lines of manufactured supplies the benefits of the main organization. It is in a sense as if the supply manufacturers were united in individual organizations and then linked together through a main association in which each one had representation. Actually, however, the membership is held in the parent organization and affiliation with sections is a supplementary procedure to membership in the association.

Section Organizations

The organization of the sections is substantially uniform. Each has a chairman, a secretary and a treasurer, with committees covering the special line of product embraced in the work of the sections, in order to centralize and develop their activities. At the commencement of the Associated Manufacturers' movement the sections appeared to be in effect committees of the main association, but they have grown even past the expectations of the enthusiastic organizers. The attendance and interest in the work of the sections are maintained with unflagging zeal.

While each section is a unit in itself, subject to the authority of the parent association, all have problems of the same character to meet. Under these conditions the nature of the work, inquiry and investigation of the different sections has closely approached uniformity. Necessarily the steady progress in standardization and in some other directions is rightly confined to individual lines in individual sections, but there are many activities in which all sections have a common interest.

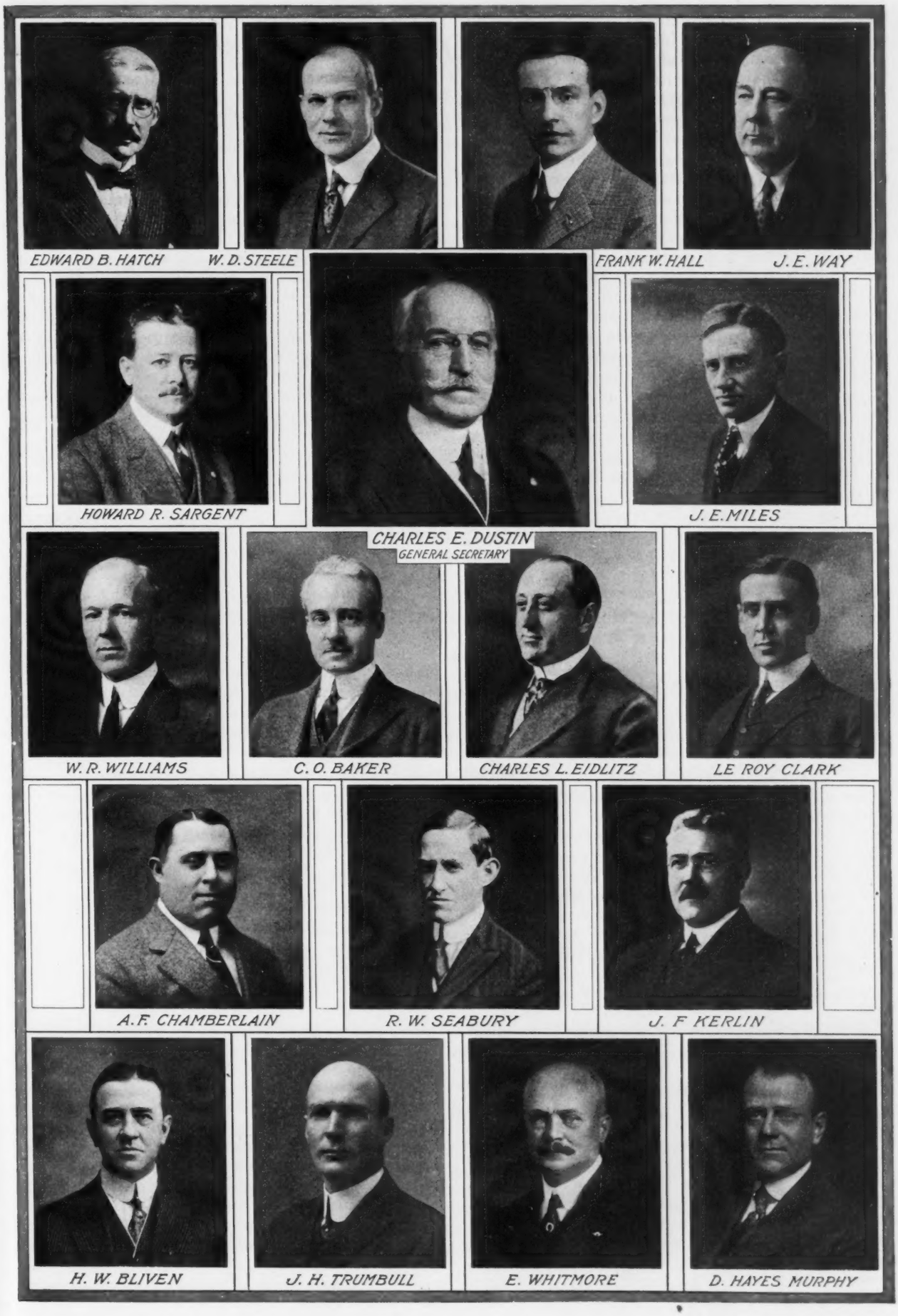
Through its representation on the general war committee of the electrical manufacturing industry assistance will be given the government in meeting its requirements efficiently and with the minimum of industrial disturbance.

War Service Committee's Work

It is upon the foundation laid by the three organizations that the general war service committee of the electrical manufacturing industry has built its comprehensive, far-reaching system. As readers of the Electrical World know, the general war service committee of the electrical manufacturing industry consists of two members each from the three organizations. Sub-committees will be created in each of these organizations to meet such demands as may arise from time to time. With the Associated Manufacturers of Electrical Supplies, which extends into so many distinct lines of activity involving a large membership, it has been found desirable to form about twenty subsidiary committees from the sections, representing different lines of electrical supplies. The thoroughness with which the work of organization of the subsidiary committees has been done is characteristic of the completeness with which the Associated Manufacturers' organization has been perfected in other directions.

In these committees the term "section" is abandoned. The committees are regarded as representing groups of the industry, as, for instance, the wire and cable group. It was decided to forgo the term section because members regard the war service work as primarily in the interest of co-operation with the government. They wish to cover the whole industry, not alone that part, though large, which is in the association, and they therefore offer the services of the various war committees to any manufacturer.

Without the organization of sections which has been built up by the Associated Manufacturers of Electrical Supplies it would have been impossible to form almost instantly when the demand arose so extensive a system of war service committees as has been developed. Time would have been spent in bringing people together. Trade antagonisms would have had to be overcome. In place of this feeling there would have had to be built up the new spirit of co-operation, in-


EDWARD B. HATCH
W. D. STEELE
FRANK W. HALL
J. E. WAY
HOWARD R. SARGENT
CHARLES E. DUSTIN
GENERAL SECRETARY
J. E. MILES
W. R. WILLIAMS
C. O. BAKER
CHARLES L. EIDLITZ
LE ROY CLARK
A. F. CHAMBERLAIN
R. W. SEABURY
J. F KERLIN
H. W. BLIVEN
J. H. TRUMBULL
E. WHITMORE
D. HAYES MURPHY

tensified beyond the powers of imagination by the entrance of the country into the world war. The necessity of doing this crudely and hurriedly under the spur of sharp necessity due to war has been obviated by the existing organization, which without delay provided the useful machinery for creating war service committees. The association formed the sections for justified trade purposes before war loomed; the country is at once benefited when war comes.

Little limitation is placed on the activities of the sections of the Associated Manufacturers of Electrical Supplies. Generally they may map out their own work and do it through such conferences or committees as seem to them to offer the most effective means. However, all that they accomplish is subject to the approval of the board of governors of the main association, acting on advice of the counsel, before it can become officially the product of the organization. Through this authority, which is exercised continually, the board of governors is able to hold the work of the different sections to conformity with the constitution and the spirit of the organization. By this method of control the sections are guided so effectively that all their activities are strictly in accord with both the letter and the spirit of the law.

On the preceding page are printed photographs of chairmen of the various sections and also of Charles E. Dustin, the general secretary, through whose office the principal work of the sections passes before action is taken on it by the board of governors.

The chairmen of the sixteen sections are:

Attachment Plug Section.—H. W. Bliven, Harvey Hubbell, Inc.

Carbon Section.—J. F. Kerlin, National Carbon Company.

Fan Motor Section.—A. F. Chamberlain, Robbins & Myers Company.

Fuse Section.—H. R. Sargent, General Electric Company.

Industrial and Street-Lighting Fixture Section.—C. O. Baker, Wheeler Reflector Company.

Insulating Materials Section.—J. G. Miles, Westinghouse Electric & Manufacturing Company.

Interior Conduit Section.—D. H. Murphy, American Conduit Manufacturing Company.

Knife Switch Section.—J. H. Trumbull, Trumbull Electric Manufacturing Company.

Lamp Receptacle and Socket Section.—W. D. Steele, Benjamin Electric Manufacturing Company.

Line Material Section.—W. R. Williams, General Electric Company.

Molded or Formed Insulation Section.—Edward B. Hatch, Johns-Pratt Company, has just resigned as chairman. R. W. Seabury, Boonton Rubber Manufacturing Company, has been elected to succeed him.

Outlet Box Section.—Frank W. Hall, Sprague Electric Works.

Panelboard and Switchboard Section.—Charles L. Eidlitz, Metropolitan Electric Manufacturing Company.

Porcelain Section.—J. E. Way, R. Thomas & Sons Company.

Snap Switch Section.—E. Whitmore, Manhattan Electrical Supply Company.

Wire and Cable Section.—LeRoy Clark, Safety Insulated Wire & Cable Company.

Formed in 1915, the Associated Manufacturers of Electrical Supplies had as its first president Robert K. Sheppard, Simplex Wire & Cable Company. H. B. Crouse, Crouse-Hinds Company, the present president, was elected in 1917 to succeed Mr. Sheppard. A. W. Berresford, Cutler-Hammer Manufacturing Company, is vice-president, and J. W. Perry, H. W. Johns-Manville Company, is treasurer.

ARRESTERS ON 150,000-VOLT ENERGY-TRANSMISSION LINE

Results of Investigations of Electrolytic Lightning Arresters on These Lines Given—Method of Overhauling Arresters

BY H. H. COX.

When the 150,000-volt Big Creek system was put in operation six sets of electrolytic lightning arresters were installed, two at each power house and two at the receiving substation. None was installed along the line at any point, but instead each string of insulators on the line was provided with arcing horns. Occasionally there are insulator flashovers, but they seldom occur within 30 miles (48.3 km.) of either the power houses or the substation. Their cause is not definitely known or understood. They occur under any and all load and weather conditions. A few cases only of actual insulator breakdown have occurred. It would appear that the protection afforded by the arresters does not extend more than 30 miles.

Probably the most important function performed by these arresters is the discharging of switching disturbances. The gap setting has been decreased from that recommended by the manufacturers until it is now only about 60 per cent of the minimum given in the instruction book. The present setting, which has been arrived at by trial method, is 10½ in. and 14 in. (26.7 cm. and 35.5 cm.) at the substation and 13 in. and 17 in. (33 cm. and 43.2 cm.) at the power houses. The higher setting at the power house is due to the configuration of the ground at that point.

Charging current is measured once a month and curves are plotted on it. Arresters at one power house were taken out of service after about two and one-half years on account of increasing charging current. The trouble was found to be that the electrolyte had congealed. These arresters have not been put back into service. Those at the substation were overhauled and new electrolyte put in after three years' service. The charging current had not materially increased, however. Those at the other power house are still in service and are apparently in good condition after four years' service.

In overhauling those at the substation it was found that about 2 per cent of the cones were bad. These were rough and pitted on the surface covered by the electrolyte, and in every case it was plain to be seen that the trouble was due to low electrolyte. These cones were generally distributed through the stacks. When the stacks were reassembled an original method was used by which absolutely uniform filling was obtained. The cones were filled by the usual rubber tube and siphon method, but no particular care was taken about the uniformity. When full the stack was carefully leaned over against the wall until the electrolyte in a properly filled cone just started to spill over. Then those too full ran over until down to the proper level, and it was but a few minutes' work to run over the stack with a rubber tube and fill up the low ones.

In giving the initial charge after refilling only one cell was found in 2800 which would not build up the film. From the foregoing it would seem that the cones would last a long time in the service these arresters are doing.

How System Operators Can Improve Economy

Proper Qualifications of Load Dispatchers—Relations with Station Operators and Line Patrolmen—Coal Saving Proved to Be Possible Through Studying Hydroelectric Conditions

BY HARRY J. BURTON

Consumers' Power Company, Jackson, Mich.

IN ORDER properly to conserve the energies and resources of a modern interconnected transmission system, made up of hydroelectric plants, steam plants and substations, the services of well-trained, competent load dispatchers or system operators are essential. Men of broad operating experience are needed for positions of this kind. They must be familiar with the operation of steam plants, water plants and substations, and with the care and maintenance of high-tension transmission lines.

System operators are in a particularly favorable position for observing the general status of an operating department, and with the guidance of their executives should be able to bring about successful and economical operation.

To operate to the best possible advantage the authority of the system operator should extend to the lines, stations and men, in maintaining the necessary operating conditions. Emphasis should be placed upon the importance of co-operation between all departments and the system operator. Pertinent information withheld from the system operator may result in serious loss to a company.

System operators should at all times be familiar with all the operating conditions existing at the various stations, substations and switching points. They should know the kind of coal used and the cost of it, unloaded, at the different steam plants. They should know the load at which the different generating units operate most efficiently, and the information they receive must be accurate if good and efficient work is to be done. They should be kept informed of the demands for power and of all changes in load as far in advance as possible, so that they can arrange to have different units placed in or out of service at the right time.

Responsibility of System Operator

Generating apparatus should not be placed in or out of service without the permission of the system operator, and on small systems boiler-room men should not be allowed to cut boilers in or out of service or to clean fires without his sanction. On larger systems he should at least know how many are available for service at all times. Boiler-room economy is of the utmost importance these days, and boilers should be operated at the most efficient load. Steam plants should not be run with more boilers in service than are actually needed; that is, ten boilers should not be fired when only eight are needed to carry the load. The load curve on steam plants should be straight for efficient and economical operation; that is, a good load factor should be maintained. Boilers can be prevented from "blowing off" during the noon hour and light-load periods by an intelligent handling of the water at hydroelectric plants.

System operators should aim to take care of peak loads with water power, and, as far as is practicable, water should be conserved for these periods. Sundays, holidays and other light-load periods can often be taken care of by means of water power, thus affording an opportune time to inspect, clean and repair steam-plant equipment.

Hydroelectric Conditions and Coal Saving

Much energy can be conserved by a careful study of water conditions at the hydroelectric plants. The nature of the watershed, the amount and time of precipitation and the climatic conditions all affect operation, and some understanding of the flow and formation of a river is needed to know how soon or how much the pond would be affected after a given precipitation or thawing. The operation of floodgates should be checked up from time to time to see that they are in working order, as failure of these gates to work at a critical time may result in much damage and loss.

The determination of the most effective gate opening and the working of water down a river, through several water plants, as well as the handling of plants at times of low and high water, are economic problems that should be worked out so that, if possible, no water shall be wasted, the plants operated at the most effective head and a degree of protection maintained at all times. When extensive repairs to lines or equipment are contemplated, making it necessary to shut down a plant for a considerable period, the system operator should be informed as far in advance as possible so that he can arrange to use all the available water; thus as little as possible will be spilled while the repairs or changes are under way.

System operators should have sketches showing the high-tension wiring in all power stations, substations and switching houses and data showing pole numbers at the principal points along the lines, such as road crossings, trolley stops, telephone test stations and other items descriptive of the lines that would be of assistance in handling intelligently any case of line trouble that may develop. They should keep themselves informed as to the immediate whereabouts of patrolmen, linemen, repairmen and all superior officers, so that there will be no delay in securing help or advice in an emergency.

Competent line patrolmen are an invaluable help to the system operator, and reliable information received from them and acted upon may not only save equipment and prevent an interruption to service but may also eliminate a long period of inefficient operation. For example, a system operator may have planned to use a certain line and plants to carry an important load, and owing to the failure of the line, or to trouble on it, he may be forced to use a line and plants less efficient, and in addition water may be wasted at some of the dams. Accurate information received from a patrolman may prevent the trouble entirely or else give the system oper-

ator time to plan for the most efficient way out of the trouble, should it prove to be inevitable.

System operators should give careful consideration to all high-tension line disturbances or surges that are reported. They may be caused by an arcing ground, and it is a well-established fact that trouble of this nature sets up surges and causes stresses, on delta-connected systems, which tend to weaken insulation on all lines and apparatus connected metallically to the defective part. Arcing grounds must be located and cleared from the system as soon as possible. An experienced operator should have little difficulty in locating transmission-line trouble on a modern high-tension system.

Weather conditions and approaching storms should be carefully noted and suitable preparations to take care of possible trouble should be made by checking up the whereabouts of patrolmen, linemen and repairmen. Reliable means of communication between the system operator and patrolmen, switching points and stations must be maintained, and the system operator should give this important matter careful thought and be prepared to act promptly should one of his lines of communication fail. System operators' messages over the private telephone line should be given preference, and it should be understood by all concerned that any instructions given by them regarding the generation and disposition of power should take precedence over all other instructions. Important messages should always be repeated.

The question of proper discipline is an important matter, and the morale of the men, as well as the condition of the equipment under their care, should have special consideration. All concerned should understand that co-operation with the system operator tends toward safe, continuous and efficient work.

Book Reviews

THE ELECTRIC VEHICLE HANDBOOK. Fifth annual edition. By Frank W. Smith and H. C. Cushing, Jr. New York: H. C. Cushing, Jr. 388 pages, 200 illustrations. Price, $2.

In bringing this new edition of "The Electric Vehicle Handbook" up to date the authors have had the assistance of William P. Kennedy, consulting transportation engineer, together with the best-known experts in the country on the practical operation and care of the electric vehicle, its storage batteries, motors and accessories. Thomas A. Edison is quoted as saying: "We have needed just the information contained in its pages." It is the only book on the subject published and has proved a valuable reference work for the owner or operator of an electric vehicle of any class.

THE MYSTERY OF MATTER AND ENERGY. By Dr. Albert C. Crehore. New York: D. Van Nostrand Company. 162 pages, illustrated. Price, $1.

A fascinating little volume, designed to stimulate interest and inquiry in the physics of the microcosm. We human beings live in a world of dimensions capable of directly appealing to our senses. Exactly what these dimensions are is naturally a debatable question; but let us state it as ranging from, say, a millimeter up to say a few megameters, or through a ratio of about 10^{10}, with a geometric mean at 100 meters. Outside of this immediate world astronomy opens up a vastly greater or megacosmic universe, commencing say at 10^{10} meters and running up to what outer limit we know not, but up to discussed limits of 10^{20} meters, another range of 10^{10} meters, with a geometric mean at 10^{15} meters, or roughly 0.1 light-year. Inside of our immediate world, physics opens up a vastly more minute or microcosmic universe, commencing, say, at 10^{-6} meter and working down to what inner limit we know not, but up to discussed limits of 10^{-16} meter, another range of 10^{10}, with a geometric mean at 10^{-13} meter, a distance suitable for discussing electronic orbits. At the present time, physicists are much engaged in unraveling the mysteries of the microcosmic universe. They seem to be as wonderful as those of the megacosmic or stellar universe. The ultimate laws of matter, gravitation and radiation are intimately connected with the microcosmic world. It may well happen, indeed, that the ultimate conditions of the planets in the stellar universe may be worked out from discoveries yet to be made in the microcosmic universe. The book is written without algebra, but it contains some beautiful geometrical drawings and atomic-model pictures. The volume is to be recommended to all educated persons possessing some general knowledge of physics who are interested in the most recent investigations within the microcosmic world.

THE THEORY OF THE SUBMARINE TELEGRAPH AND TELEPHONE CABLE. By H. W. Malcolm. London, England: The Electrician Printing & Publishing Company, Ltd. 566 pages, 198 illustrations. Price, 18s.

This is a good textbook on the mathematical theory of submarine-cable telegraphy and telephony. It divides itself into two portions or groups of chapters, namely, (1) those which deal with the theory of steady-state simple alternating-current transmission over cables, and (2) those which deal with the theory of transients or arrival curves on such cables. The former theory is not new, having been developed by other writers in the past. The latter theory is new in its development. It was merely outlined by Kelvin and Heaviside. This book makes, therefore, a valuable and much needed contribution to the knowledge of the transient or unsteady state in submarine cables, whereby the arrival curves may be computed under any assigned set of ordinary signaling conditions at the sending and receiving ends. The chapters relate to the following subjects: Mathematical recapitulation, fundamental cable constants, transient and periodic phenomena, the telegraphic equation and its periodic solution, the methods of loading cables, discontinuities and reflections, alternating-current measurements, the telegraphic equation and its transient solution, the part played by signaling apparatus, sending phenomena and the influence of leaks, signaling by inverse currents, sine-wave transmission, distortion and how it is produced, present-day methods of overcoming distortion, the duplexed cable, and the loaded telegraph cable. The volume will be of great value as a reference book to cable telegraphists and to students of electric signaling who have had a good mathematical training.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

THE COST OF INSTALLING UNDERGROUND CONSTRUCTION

Compilation of Expenditure for Average-Sized Conduits Which Should Enable Engineers to Estimate the Cost of Construction Approximately

The following data giving construction costs for an average-sized conduit have been compiled by the National Fireproofing Company of Pittsburgh, Pa. In computing these costs certain basic figures (Table I) were used which will naturally vary in different localities.

TABLE I—BASIS COSTS USED IN CALCULATING COSTS OF UNDERGROUND CONSTRUCTION

	Cost Per Cu. Yd.
Excavating trench	$0.70
Back-filling trench	0.25
Laying conduit	0.0075*
Mixing and wheeling concrete	0.70
Removing surplus dirt	1.60
Cost of aggregate for concrete	1.53†
Cost of cement	0.002*

*Per duct foot. †Per barrel delivered.

So much conduit is run in suburban and cross-country districts where there is no pavement to replace, as well as under streets previous to paving them, that the cost of replacing pavement does not always have to be considered. When it is necessary to remove and replace pavements, however, the average cost thereof can be found in Table II.

TABLE II—COST OF REPLACING DIFFERENT KINDS OF PAVEMENTS

	Cost Per Duct Foot
Granite block on sand	$0.0147
Brick on sand	0.0147
Brick on concrete	0.0294
Asphalt on concrete	0.0441
Cement sidewalk	0.0147

The figures shown in Table III may be used safely in approximating the cost of materials and labor for brick manholes having concrete floors, sewer connection, reinforced-concrete top and cast-iron frame and cover.

TABLE III—COST OF BRICK MANHOLES*

Number of Ducts	Inside Dimensions (Ft.)			Average Cost		
	Length	Width	Height	Labor	Material	Total
1 to 3	5	3½	4	$24	$32	$56
4 to 8	5	3½	5	26	36	62
9 to 12	6	4	6	35	45	80
13 to 24	7	5	6	45	54	99

*For concrete manholes approximately 25 per cent less than the above values should be estimated.

The following schedule of costs is compiled to serve as a guide in making up of estimates only and is such as will cover average conditions in any district of a city. These figures include cost of all materials (the duct excepted), excavating, removing dirt, mixing and placing concrete, hauling and laying duct, replacing pavement and the expense of city inspection. The

TABLE IV—AVERAGE COST PER DUCT FOOT UNDER DIFFERENT PAVEMENTS

Number of Ducts in Trench	Grass Plot or Unpaved Street	Macadam, Cobble or Wood Block on Sand	Wood Block on Concrete	Asphalt, Grouted Brick or Granite Block on Concrete
2	$0.150	$0.180	$0.250	$0.300
3	0.120	0.134	0.165	0.200
4	0.090	0.100	0.133	0.160
6	0.070	0.079	0.110	0.120
8	0.060	0.066	0.098	0.110
9	0.055	0.062	0.094	0.105
10	0.053	0.059	0.090	0.102
12	0.050	0.055	0.085	0.096
14	0.047	0.052	0.081	0.092
16	0.044	0.048	0.077	0.088
18	0.042	0.046	0.074	0.085
20	0.040	0.044	0.071	0.082
22	0.039	0.042	0.069	0.080
24	0.038	0.041	0.066	0.078
26	0.037	0.040	0.065	0.076
28	0.036	0.039	0.064	0.075
30	0.035	0.038	0.062	0.074
48	0.032	0.036	0.060	0.071

figures are based on the supposition that the duct line is surrounded with 3 in. (7.6 cm.) of concrete and that the top of the ducts is placed 24 in. (0.6 m.) beneath the pavement surface.

USE OF METERING EQUIPMENT SAVES TRANSFORMER PURCHASE

Rearrangement of Equipment in Distribution System Made Possible by Careful Measurements Eliminates Immediate Expenditure

Striving toward conservation of essential materials in accord with the spirit of the times, the Plymouth (Ind.) Electric Light & Power Company recently worked out a scheme for utilizing existing transformers more efficiently and thus avoided purchasing additional units. In general the plan consisted simply of making load measurements on certain transformers to ascertain what units could be relocated to better advantage as regards their capacities. The apparatus used in making the measurements consisted of two sets of current transformers and one graphic meter. One set of transformers were rated at 160/5 amp., 2500 volts each, and the other at 20/5 amp., 2500 volts each. The meter was a Westinghouse type U, with an eight-day clock and

a 5-amp. scale. This equipment was all placed in a single box in such fashion that several desirable circuit changes could be made on a plug board constructed as a part of the outfit. These circuit combinations made it possible to use the metering outfit and get proper scale deflections on the meter on transformers between 10 kw. and 60 kw. A two to one ratio instrument transformer was used on smaller units.

When a test was made the metering outfit was hung on a pole at the transformer bank. In residential districts the duration of these tests was usually from Monday until Thursday and in the business districts was usually from Friday until Monday. On motor installations records over a two-week period were sometimes taken.

As the result of forty such tests the locations of ten transformers were changed. In general it was found that units in residential districts could serve wider territory and thus release transformers to be removed to the business district, where most of the existing equipment was overloaded. Making the changes which were indicated to be possible by the tests has relieved the company for the time being of the necessity of buying transformers and has bettered the voltage regulation of the system as a whole.

HINTS FOR LINE FOREMEN IN CASE OF ACCIDENTS

Method of Procedure When Accidents Occur to Men—Two Essentials Must Be Looked to Promptly—Keeping Cool

The most soul-trying time that comes in connection with the duties of a line foreman is the time when from one cause or another one of his men receives a fatal or dangerous electric shock or burn. Under the stress of such a situation, particularly if the victim is suspended on his safety belt or lying across a high-tension line, many men go to pieces or at least become so excited that no concerted action may be expected. When such an occurrence takes place two essentials should be looked to promptly:

1. The injured man must be brought to the ground as speedily as possible and artificial respiration commenced at once.

2. No time should be lost in summoning medical aid and the company's resuscitating device.

The first of these must be left to the foreman to handle as he may, but he should be relieved of all responsibility regarding the second. This may be accomplished by detailing either the driver or one of the groundmen to reach for the nearest telephone and start the machinery in motion which will bring aid to the scene. The driver is the logical man for this work and should have it regularly impressed on him that this is his "bit" in such an event. By impressing on the men the part they are to play in event of accident the natural confusion will be reduced to a minimum.

Rules for the protection of electrical workmen may be multiplied indefinitely to good effect, but the gospel of accident prevention will be best promoted by instilling into the minds of the men the fact that they are dealing with a force so destructive and rapid in its action that no stone will be left unturned to add to their safety while working with it and that no amount of protective apparatus will effect its mission unless accompanied by an intelligent and careful co-operation on their part.

The above considerations were brought out by W. C. Pearce, superintendent electrical department Syracuse (N. Y.) Lighting Company, in a paper read at the recent meeting of the National Safety Council.

METHOD USED IN BOSTON TO CONSTRUCT LATERALS

Underground Laterals Are Installed to Care Only for Services Which Are Definitely Contemplated, Thus Avoiding Useless Construction

The policy followed by the Edison Electric Illuminating Company in constructing underground lateral lines and manholes connected with the main line was outlined recently before the Masachusetts Gas and Electric Light Commission by L. L. Elden, electrical superintendent of the company.

The policy that is carried out is to lay such structures to take care of business of which the company has knowledge at the moment, instead of attempting to build for the future development of particular districts. Some years ago the company attempted to lay down laterals in a Boston development where two or three streets had not been accepted, installing ducts to the lot line upon the assurance of property owners that houses were going to be built. About fifty spare ducts were put in, but the plan was unsatisfactory on account of the irregular and uncertain development. In some cases a purchaser would buy two adjoining lots, erecting a house in the middle of the parcel thus obtained and so throwing one service duct out of usefulness, to say nothing of introducing a change in the symmetry of the feed location. In another case a driveway was built in a location which made the lateral useless.

On account of these uncertainties the Boston company now builds only for immediate business. When the city lays out a new underground district the sales force canvasses every house in the region. If the company secures the business in some new locations it installs the pipes, but otherwise no spare pipes go in. At least 25 per cent of all Boston Edison manholes have been built after construction of the main lines of conduit.

FAN ENGINE MOUNTING

Engine Is Mounted in Turbine Room, Affording a Compact Arrangement

At the Farmingdale station of the Central Maine Power Company a fan engine connected with the boiler draft supply is mounted in the turbine room on a reinforced concrete platform, instead of being placed in the boiler room proper, as is generally the case. The platform is carried about 10 ft. (3 m.) above the floor, and, in addition to providing turbine room supervision for the engine, enables the outfit to be operated in space of little use for other purposes. A short connection with flange coupling runs through the wall between turbine and boiler rooms and a secondary platform above the base of the engine with appropriate ladder connection enables the cylinder and valves to be inspected with ease. The arrangement is compact and affords maximum cleanliness of operation.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

THE CREDIT DEPARTMENT'S RELATIONS WITH CUSTOMERS

Courteous, Firm and Painstaking Methods Used to Collect the Past-Due Accounts, with Service Discontinued Only as Last Resort

There are many ways of collecting accounts. Methods employed by some companies irritate and antagonize customers. Other methods create respect. In some instances collection departments set out with the avowed intention of creating a reputation for harshly handling customers in order that the customers' fear of such handling shall assist in reducing a number of overdue accounts. Some utilities have been known to go so far as intentionally to attract the attention of the delinquent's neighbors to the fact that trouble is ensuing over the payment of a bill. In general, however, this is not the accepted plan among more progressive central stations. Their plan generally is to adopt systematic, thorough and painstaking but withal firm measures of insisting upon payment. It is the endeavor to cultivate the good will of the customer rather than to antagonize him.

METHODS OF A MIDDLE WEST COMPANY

As characteristic of these practices the following description of methods employed by the credit manager of a Middle Western electric lighting utility is of interest: This collection system requires the rendering of three statements on all delinquent accounts, namely, the memorandum of arrears, the collector's statement and the "Important" statement. Formerly these statements were printed on addressographs from stencils used for printing the bills and were filled in by longhand by statement clerks. Recently, however, the department has adopted a very modern system of rendering these statements through the use of four Underwood-type fanfold statement machines. The operation is now so handled that six copies are made in one operation, namely, memorandum of arrears, cashier's stub of memorandum, "Important" statement, cashier's stub of "Important" statement, collector's statement, office copy of collector's statement.

When an account is ten days past due—that is, twenty days after the bill has been rendered—the company sends the customer by mail the memorandum of arrears, in which is printed the following paragraph:

"Please note that bills listed above have not been paid. As same are past due, the favor of your remittance by return mail is requested."

This statement usually brings payment from customers who have misplaced or neglected their bills. To those who pay no attention to it, it is necessary to render the collector's statement. This is sent out ten days after the memorandum of arrears statement was mailed. The collector's statement is made in duplicate, one copy being for the collector and one for the office records. It constitutes the first call statement and is the beginning of the collection department's intimate relations with the customer. If the collector is not successful in securing the money on the first call, he leaves a collector's first notice, which shows the amount due and reads as follows:

"Your attention is called to your past due and unpaid account for electricity amounting to $——, covering dates for electrical merchandise $——, electric wiring $——. Please remit or call at our office and make payment without delay."

Five days later, if no collection has been made, the "Important" statement is mailed. This bears a shut-off notice reading as follows:

"We beg to draw your attention to your past-due account as listed above. We request that this account be paid before the close of business on ——. Otherwise we shall be obliged, with regret, to enforce our rule relative to discontinuing service."

After allowing three days for the customer to make payment the collector makes his second call to collect or discontinue service. He must, however, interview the customer and get his refusal to pay before service is discontinued. In the event that the customer is not at home he will not shut off the service, but will leave a final shut-off notice which reads as follows:

"We beg to advise that, in accordance with notice sent you for your unpaid account for electricity amounting to $——, call has been made to-day to shut off service. We hope you will render this action unnecessary by paying bill at once at the main office."

THE THIRD AND LAST CALL

This means that the third call must be made if the customer does not remit. On the third call the customer must pay or service will be discontinued. If conditions are such that the collector cannot reach the meter, the case is turned over to the repair department to collect account or to discontinue service if necessary at the pole. Before this action is taken, however, a letter is addressed to the customer informing him that such action will be taken if the account is not paid. In the event that the service is shut off the collector leaves a slip at the meter showing the amount of the overdue account which was the cause of discontinuing service. Upon the payment of this account the customer can have the service reconnected the same day it is discontinued.

As these various steps are taken memoranda are made on the customer's account at the office so that any inquiry as to the status of his account may be answered.

After service has been discontinued for non-payment

the report is held fifteen days, during which time another call is made to collect the account if possible. If the account is not paid, the contract department is informed of the situation and requested to issue an order to have the meter removed.

DEALING WITH CUSTOMERS WHO HAVE MOVED

The next task of the collection department is to get the money on the final accounts of customers who have moved or whose meters were removed on account of non-payment.

First in order, there is the case of the customer who has moved and is using service at another address. If the balance owed is less than $1.50, the amount is added to his bill, which will be sent to the new address. If the amount is more than $1.50, it is given to a collector. If he does not secure the balance, he will leave a notice for the customer. If the customer then does not remit within ten days, another letter is sent requesting payment. Ten days later, if the account has not been paid, a shut-off notice letter is mailed stating that service will be discontinued within three days.

Second, there is the case of the customer owing a final account who gave the company his new address at the time he ordered service discontinued but who is not using service at the new address. The collector calls upon this man and, if he cannot collect the amount, leaves a notice that the balance is due. If payment is not made within ten days, two letters are written at intervals of ten days requesting payment. If remittance is not made then, the collector makes another call. If he is unable then to collect the amount or to get satisfactory promise of payment, credit data are referred to.

If the correct business address of the customer is shown in the credit data, a call is made at this address and then a letter is sent to the business address stating that the account will be sent to an attorney for payment if it is not settled. After this a few more calls are made by the collector to establish definitely the fact that it is impossible to get the money. Then the account is turned over to the company's attorney with all of the collector's reports, copies of letters, credit data, etc. A card is also filed in the credit department's suspense file to prevent the delinquent from securing further service from the company while his account remains unpaid.

Throughout all of these operations it is the intention of the department to exercise patience and to endeavor to cultivate the good will of the customer and at the same time to establish in the mind of the customer respect for the collection department.

UTILITIES REDUCING STOCK OF THE MATERIAL ON HAND

Economic Measure Which Conserves Both Labor and Capital for the Central Station Company, Besides Reducing Insurance Carried

There is at present a quite general movement among central-station companies to reduce the stock of material carried in the warehouses and storerooms. This movement is tending not only toward carrying a smaller quantity of supplies but also toward making use wherever possible of material on hand and the conversion into money of all surplus material. Quite naturally, this movement carries with it also a corresponding reduction in the amount of insurance which will be carried.

Back of the movement is the desire to conserve capital and to conserve labor. Reducing stocks not only releases money actually tied up in the goods in the wareroom, when this material is used and is not replaced, but in many cases brings to light material which can be resold at present prices with a considerable profit.

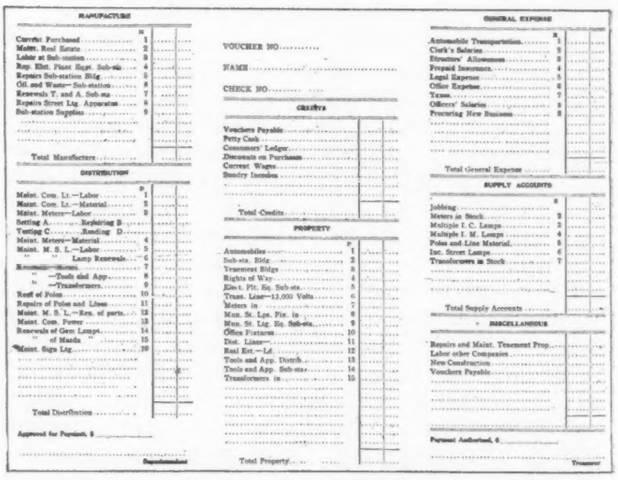
This applies only to such material, of course, as is not likely to be needed in the near future. In some instances the stock reductions have been of such extent as to justify reducing the amount of insurance carried, which also effects a saving. With the reduction of stocks carried it is also possible to effect a saving in the amount of labor necessary to handle the stock and in the amount of labor required in taking inventory, two considerations of importance.

METHOD FOR SAVING TIME IN THE FILING OF VOUCHERS

Manila Envelopes Provided for Filing, with Provision for All Account Titles and Numbers, Amounts and Totals

The Agawam (Mass.) Electric Company and affiliated central stations, under the management of the Cabot interests of Boston, file vouchers most conveniently by making use of a method which is described in the following paragraphs:

Vouchers are properly classified under account numbers and are then kept in manila envelopes about



FACE OF THE ENVELOPE FOR FILING VOUCHERS WHICH IS USED BY A MASSACHUSETTS CENTRAL STATION

9 in. by 11½ in. (22.8 cm. by 29.2 cm.) in dimensions, the face of each envelope carrying all account titles and numbers, with space for amounts and totals under each class, as shown in the illustration which accompanies this article.

Provision is also made for approval signatures, and a record of the check number paying the account and other information can be inscribed in the open spaces which are left on the envelope to serve the convenience of the office.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Lamps and Lighting

An Indirect Lighting System in a Textile Plant.—GEORGE WRIGLEY.—For obvious reasons it is frequently desirable in lighting industrial plants to use a small number of large units rather than many small units, provided that uniform illumination without excessive glare can be obtained. With direct lighting reflectors the size of unit is limited by such physical features as ceiling height and machinery spacing. This paper describes a system embodying the use of the largest approved size high-efficiency incandescent lighting unit, arranged to give the best possible working conditions for the operatives.—*Illuminating Engineering Society.*

Effective Lighting of Factories as Judged by Daylight Standards.—WARD HARRISON.—The author points out that because of the high power and concentration of present light sources greater care must be taken in selection of diffusing accessories to minimize glare and specular reflection, to provide a directed light of ample intensity on both horizontal and vertical surfaces, and to give soft shadows. Consideration is given to the limiting brightness values governing the choice of equipment for different classes of factory lighting. The common forms of factory units are compared as to fulfillment of lighting requirements. In this connection a new diffusing unit, consisting of a large porcelain steel reflector of special design in combination with a silvered lamp cap, is described. Tests of actual working daylight intensities in a number of workshops are reported. Results of an investigation of factory rental costs are shown, and the marked savings in production cost through double-shift operation feasible with artificial lighting of a daylight standard are calculated.—*Transactions I. E. S.*, Nov. 20, 1917.

Generation, Transmission and Distribution

Plans for Long-Distance Transmission.—F. NIETHAMMER.—In the course of an article on the development of a hypothetical electric-service system covering an entire country with its branch stations and 100,000-volt transmission lines the author mentions some interesting figures concerning Germany's consumption of electrical energy in 1916. From 2,600 000,000 kw.-hr. in 1913 the consumption jumped to more than 10,000,000,000 kw.-hr. in 1916, or practically four times as much. The enormous value of hydroelectric power has been impressed upon Austria and Germany, and plans are already under way for the utilization of all the swift mountain currents and waterfalls in the Austrian Alps for manufacturing purposes. Within the next quarter of a century Germany plans completely to electrify its railways and to erect central generating stations, using water power and the vast fields of turf and bituminous coal. All machinery is to be driven electrically, all lights and all heating in cities to be by electricity. Preliminary surveys and plans are already under way.—*Elektrotechnik und Maschinenbau*, Nov. 11, 1917.

Traction

Voltage Rises in Third-Rail Circuits.—D. D. EWING.—A study of the causes of high-voltage rises in third-rail systems is presented in this article, together with oscillograms of such surges. Rises in voltage of two or three times the normal were found possible.—*Electric Railway Journal*, Dec. 15, 1917.

Tramways Render Invaluable Service in Halifax Disaster.—The tramway company at Halifax, N. S., came through the recent disaster with loss of few employees and comparatively little damage to power plant, track and rolling stock. Its speedy resumption of operation was of great assistance in the work of recovery.—*Electric Railway Journal*, Dec. 15, 1917.

Electric Traction in Italy.—A reprint from the report of a parliamentary commission of inquiry into the state railways of Italy, the use of electricity on which dates from 1900, when two systems were inaugurated—one on the Valtellinesi railroad, in the Adriatic district, where three-phase alternating current was used, and one on the Milan-Varese railroad, in the Mediterranean district, where direct current and the third-rail were employed. The former system now has 276.9 km. (172 miles) of single track and 113.7 km. (70.6 miles) of double track, and the latter system has 58.5 km. (36.3 miles) of double track, or a total for the two systems of 449.1 km. (279 miles) electrified. An elaborate table of cost of operation per kilometer as compared with the cost of operation by steam locomotives is included in the article.—*L'Ettrotecnica*, Nov. 15, 1917.

Installations, Systems and Appliances

Mechanically Operated Furnaces.—M. LAMOTTE.—The ever-growing cost of coal makes the utility of mechanically operated furnaces as compared with hand-operated ones a matter of prime importance. Even the most nearly perfect furnaces will differ from 15 to 20 per cent in the amount of fuel consumed when controlled by different firemen. The author takes up the questions of automatic draft and of mechanical feeding and stoking, considering in turn the various forms of apparatus devised for these purposes, the underfeed and endless-chain grates, etc., of different makes. To a questionnaire responded to by twenty establishments widely varying answers were received. One firm, for instance, puts the maintenance cost—material and labor—per grate per hour of operation with one system at nearly seven times, and with another system at nearly eighteen times, the figures reported by another firm for the system used by it. Similarly, the high-estimate firm puts the cost of operation per grate at six times the sum reported by the low-estimate firm.

The amount of fuel consumed by the same furnace in different establishments also varies, according to the reports, by as much as 100 per cent, depending evidently on the quality of the coal and the strength of the draft. In the presence of such divergences, the author says, further experience is necessary before exact conclusions can be drawn.—*Revue Générale de l'Electricité*, Nov. 10, 1917.

Methods for More Efficiently Utilizing Our Fuel Resources.—H. G. Barnhurst.—This article, the seventh of a series on the general utilization of pulverized coal, briefly reviews the extent of the use of pulverized coal in the Portland cement industry and then treats of its later application in other industries. It is being used more and more extensively in metal-heating furnaces, in metallurgical furnaces in the steel and copper industries, and for burning lime and dolomite for making furnace refractories. A field in which enormous quantities of this fuel will be used is in the generation of power in stationary power plants. The article refers to many low-grade solid fuels which can be utilized with good results in pulverized form, and states that the danger incident to the use of pulverized coal has been greatly exaggerated. The preparation and handling of pulverized fuel are discussed in detail in the latter part of the article.—*General Electric Review*, December, 1917.

Electrophysics and Magnetism

Faraday Society Symposium on Pyrometers and Pyrometry.—At a meeting of the Faraday Society held in London Nov. 7, 1917, the general subject of pyrometers and pyrometry was considered in its relation to metallurgy. The first paper, by E. F. Northrup, dealt with the "Production of High Temperature and Its Measurements." The author pointed out that the refractory properties of carbon offer means of obtaining high temperatures, the upper limit of which is the vaporization temperature of that element. The writer presented results of two inquiries—first, what form would an ideal furnace take? second, is it physically possible to reach this ideal electrically? The progress of electric heating is also outlined, as is the measurement of high temperature. The author urges all investigators in the field of high temperature to consider the great possibilities of the metal tin for extending the fundamental temperature scale above 1550 deg. C., the present limit of the gas thermometer. The subject of "Pyrometer Standardization" was discussed by Ezer Griffiths and F. H. Schofield of the National Physical Laboratory. The authors pointed out that it is now generally agreed that the standard scale of temperature should be the thermodynamic. The third paper was presented by Richard P. Brown on the "Automatic Control and Measurement of High Temperatures." The author showed the industrial need for automatic temperature control and the feeling of security that comes to a factory manager whose plant is thus equipped. The principles of a new heat meter developed by the writer are outlined, as are the details of an instrument to control furnace temperatures automatically.—*Metallurgical and Chemical Engineering*, Dec. 15, 1917.

Flux of Energy in Electrodynamic Field.—G. H. Livens.—The basis of the theory of energy streaming in the general electromagnetic field is briefly reviewed and the most general form of Poynting's and Macdonald's results is obtained. In addition, Macdonald's own form and an alternative are deduced, and although reasons are given for their rejection in favor of the simpler and more general type of theory first obtained, the former (Macdonald's own form) is retained throughout the succeeding discussion for purpose of illustration. The various theories are then subjected to critical examination on general grounds and subsequently in reference to their behavior in certain special fields, and it is shown that in the present state of our knowledge any alternative to Poynting's theory must be rejected as being wholly incompatible with our physical conceptions of energy and its streaming in the electromagnetic field.—*Philosophical Magazine and Journal of Science*, November, 1917.

Some Fundamental Concepts of Electrical Theory.—H. Bateman.—The author develops an electromagnetic theory based on the idea of moving lines of electric force, discussing it from three viewpoints: (1) Permanent and mutual incidence of the lines of force of the different point charges; (2) temporary incidence of lines of force of different point charges but no cutting of lines of force; (3) motion in which the lines of force can cut right through one another.—*Philosophical Magazine and Journal of Science*, November, 1917.

Units, Measurements and Instruments

Measurement of Self and Mutual Inductances.—Fred E. Pernot.—The author describes a mill method of measuring self and mutual inductances by comparison with known values of resistance and capacity.—*University of California Publications*, No. 12, Vol. 2.

Conductivity of Aluminum.—Guido Grassi.—Results of an examination made to determine the conductivity at diverse temperatures of various samples of aluminum wire as a contribution to the knowledge of the electrical constants of aluminum. Three groups of wires were experimented with, a chemical analysis producing the following results:

	Al.	*Fe.*	*Si.*	*C.*	*Cu.*	*Na.*	*Pb.*
I	98.31	1.13	0.50	0.038	Trace	0.013	Trace
II	98.61	1.00	0.36	0.012	Trace	0.011	Trace
III	98.32	1.23	0.38	0.043	Trace	0.019	Trace

The tests were made by the methods of Hockin and Matthiessen, a potentiometer being also employed in one instance, and the fact was established that the increase in the resistance of aluminum from 0 deg. to 100 deg. is proportional to the increase of the temperature. Therefore, the resistance R at temperature t may be expressed: $R = R_0 (1 + \alpha_0 t)$, where R_0 is the resistance at 0 deg. and α_0 is the coefficient of the temperature referred to 0 deg. Group II showed less resistivity than the other two groups, although it was the richest in aluminum.—*L'Ettrotecnica*, Oct. 25, 1917.

Telegraphy, Telephony and Signals

Private Automatic Telephone Systems.—A description of a telephone system for direct intercommunication by means of automatic plugs. Because of its reliable operation and small expense this system is adapted to the needs of small plants containing fewer than twenty-five instruments, where switchboards or elaborate automatic systems cannot economically be installed. The chief drawback is the ease with which a third party may "listen in" unknown to the conversers.—*Revue Générale de Electricité*, Nov. 24, 1917.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

WAR-TIME MEETING IN SOUTHERN CALIFORNIA

Annual Gathering of District Agents and Department Heads, with Earnest Discussion of Problems Under War Conditions

In the spirit of harmonious co-operation to effect every possible economy which will not impair efficiency of service, more than 150 officers, department heads and district agents of the Southern California Edison Company met at the Hotel Alexandria, Los Angeles, on Dec. 27 and earnestly discussed the conditions which confront this important public utility under the war conditions of the times.

In a spirit of optimism and cheerful compliance, with perfect comprehension of what is required and of the individual duty and collective responsibility which war imposes upon those engaged in the quasi-public service, present problems were discussed and those of the future anticipated.

THE COMPANY'S ATTITUDE TERSELY PHRASED

These excerpts from addresses pertinently express the attitude of the company. Vice-president R. H. Ballard said: "The California State Railroad Commission has indorsed this program, and our program will be, 'Do the things that are necessary and let convenience take care of itself after the war.'"

Superintendent of Sales A. W. Childs voiced this epigram: "Unfolding opportunity is the wonder of the electrical industry—the harvest is always being gathered and yet it is always waiting in greater abundance."

The program of papers and addresses was as follows: "Cutting Stationery Costs," R. E. Herman, chief of the stationery department; "Advantages of County District Lighting," W. M. McKnight, agent of the Redondo district; "How the Medical Department May Help Employees," Dr. H. C. Stinchfield, chief surgeon; "Conserving Time," W. L. Frost, assistant general agent; "Utility of the Electric Water Heater," P. J. Denninger, agent for the Whittier district; "Safeguarding the Kilowatt-Hours," H. A. Barry, electrical and mechanical engineer; "Intensive Development of Existing Circuits," A. W. Childs, superintendent of sales; "How Some Expenses Can Be Reduced," D. M. Trott, assistant comptroller; "Why the Light-Weight Car Is Advocated," P. H. Ducker, superintendent of transportation; "Shots at Sundry Targets," S. M. Kennedy, general agent; "Big Creek Hydroelectric Development," E. R. Davis, general superintendent of the northern division; "On the Threshold of 1918," R. H. Ballard, vice-president and assistant general manager.

Of the suggestions for economies and increased efficiency these were emphasized: The imperative duty of each employee being productively employed for every moment of the working day; the economic crime of wasting time in personal conversation during business hours; saving in stenographers' time by making letters shorter, omitting salutation in inter-company correspondence; single-spacing and using short letterheads; making letters take the place of trips from districts to general offices and from general offices to districts; using trolleys instead of automobiles whenever possible and practicable; revising the entire system of forms and blanks and cutting out all that are not positively essential; saving in every little detail, down to doing away with envelopes for inter-company mail and even to the use of holders for the short ends of lead pencils.

LARGE INSTALLATIONS IN 1917

Of the work of intensifying the business under existing lines two of the most important features reported were installations of electric ranges and electric water heaters. The Southern California Edison Company now outranks all other electric companies in these installations, having with the close of the year on its own territory and that of its subsidiary companies, all interconnected, 2867 ranges and 603 water heaters, having sold 1390 ranges and 478 water heaters during 1917. It was intimated that future extensions would necessarily be along very conservative lines, and that in many instances the consumer would be given an opportunity, through deposits, to help the company help him obtain the service desired.

How the "Greater Edison Company," which since its merger with the Pacific Light & Power Corporation last May distributes electricity in a domain geographically equal to Massachusetts, New Hampshire, Vermont, Connecticut, Rhode Island, Delaware and New Jersey, can best serve its consumers, safeguard its investors and do its full patriotic duty by the government, were the big problems for the coming year touched upon by Vice-president Ballard. To conserve fuel by making every drop of available water power do its work, to keep the wheels of manufacture turning, to economize without injuring, to be efficient without increasing investments and see that the money invested for that purpose was not deprived of its income, were set forth as the tasks for 1918.

KEEN INTEREST IN EVIDENCE

The meeting was characterized throughout by an intense amount of interest from those in attendance, and the able discussion of the papers and questions asked clearly indicated a keen desire on the part of the men from all parts of the company's system not only to carry out the economies planned but to suggest other directions where more economies could be either worked locally or applied to all districts.

ACROSS THE FACE OF THE GREAT WHITE WAY OF NEW YORK CITY "ICHABOD" WILL BE WRITTEN. ITS GLORY HAS DEPARTED

RIGID "LIGHTLESS" ORDER MADE FOR NEW YORK STATE

Only on Saturday Nights Will Lighting Be Permitted in Accordance with the Federal Restrictions

A new order, making every night but Saturday "lightless" in New York State, has been issued by Albert H. Wiggin, Federal Fuel Administrator for that State. This order is the outcome of the controversy over the continued illumination of electric signs in its relation to fuel scarcity and war economy, and it followed a less sweeping order previously issued.

Mr. Wiggin and his organization are studying the fuel situation through a conservation committee on fuel. An advisory committee on fuel has been appointed representing the light, heat and power companies. It is composed of L. B. Gawtry, Consolidated Gas Company, New York; F. W. Smith, United Electric Light & Power Company, and Mr. Gillam, New York Steam Company.

The new regulative order of Mr. Wiggin, effective in New York State, follows:

By virtue of powers conferred upon me, I hereby issue the following orders, to take effect Jan. 2, 1918:

1. On Saturday nights lighting is permitted, subject to the restrictions imposed by order of the United States Fuel Administration, dated Nov. 9, 1917, and order of the undersigned, dated Dec. 8, 1917.

2. On all other nights all signs of every kind, including merchants' signs, signs for theaters and all other places of entertainment, display signs, lighting on buildings and elsewhere, hotels and advertising signs, are ordered to discontinue completely.

3. Stores and offices and commercial buildings not open for business shall not use inside lights more than absolutely necessary for safety. Cluster lights and illuminations generally must be reduced to only so much lighting as is necessary for safety.

4. No more outdoor lighting shall be used than is absolutely necessary for safety of streets, passages, dangerous places and protection of the public, or as may be required by law.

5. No person, partnership, corporation or association furnishing electricity or gas or using the same shall use any coal, oil or gas or other fuel for supplying of electricity or gas, excepting subject to the restrictions and conditions contained in this order.

6. County administrators are directed promptly and strictly to enforce this order.

Harry T. Peters, chairman of the fuel conservation committee which is studying conditions for the Fuel Administration in New York, has made public the preliminary results of a survey of the amount of coal held by public service corporations. He found that in most cases unprecedented inroads were made into their reserves in December.

Mr. Peters pointed out that many thousand persons are dependent upon these companies for light and heat and millions for transportation, and expressed the opinion that any attempt to commandeer their already depleted reserves would be a serious mistake. On the contrary, Mr. Peters urged fuel administrators to devote every effort to maintaining the supply of these corporations, and said failure to do so would amount to criminal negligence.

GOVERNMENT REQUISITIONS THE NIAGARA ENERGY SUPPLY

Federal Authorities Take Absolute Control of Production So as to Assure Distribution in Accord with Essential War Needs

To protect the power supply for war industries the federal government requisitioned on Dec. 28 the energy produced, imported and distributed by the Niagara Falls Power Company, Hydraulic Power Company and Cliff Electrical Distributing Company.

A determining factor in the government decision, Washington reports say, was the demand of Canadian authorities that approximately 100,000 hp. imported from Canada be used exclusively for war work.

Statements given out in Washington indicate that it is not expected that operation of manufacturing establishments will be affected materially, as a partial redistribution of the power supply had already been arranged between the War Industries Board and Buffalo manufacturers.

About 110 manufacturers not working directly on war contracts will curtail their requirements to some extent, will use power at hours when munitions factories make minimum demands and will substitute steam for electricity as much as possible.

SHORT COAL RATIONS IN THE OHIO PLANTS

Effect of Coal Pooling Plan Noted at Toledo—Stations at Various Points Obliged to Curtail Service

While a little improvement in the coal situation in Ohio has been noted during the last week, it is still acute. There are hopes of a better supply through the government control of railroads and the coal pools established in the State recently. In Toledo the effect of the pooling plan has been noted already, but sufficient time has not elapsed for a material change at other points.

The Springfield Light, Heat & Power Company on Dec. 28 had a supply of coal that would last until Jan. 1. Some large factories announced that they would have to close at the end of last week if supplies were not secured.

Chillicothe reports indicate that the light and power station has not had more than one car of coal at a time for several days. Domestic coal is very short and some suffering is reported.

The Northern Ohio Traction & Light Company, Akron, on Dec. 28 had a three-day supply of coal, with slight prospects of securing more in time to prevent inconvenience. This company has exerted itself continually to buy coal wherever it could be had.

At Bowling Green the light station had only a small supply at the end of the week, and there was a possibility that energy would have to be discontinued at several factories.

For more than ten days the Ohio Utilities Company has discontinued service to power users at Delaware at 4.30 p.m. to save coal. It is said that coal receipts do not amount to more than half the needs.

The Findlay coal supply has been so short that light service was threatened several times in order that energy might be used to keep interurban cars in operation.

Difficulty has been encountered by the Ohio Electric Railway in securing fuel for its Lima plant, from which light and power service is furnished. Several streets and many residences have been in darkness as a consequence.

Only a few days' supply was reported at the municipal light plant in Wapakoneta the latter part of the week. The municipal plant at Lebanon is running only from 4 to 9 p.m., because of serious shortage.

The Cleveland Electric Illuminating Company and the municipal plant in Cleveland have supplies which will probably tide them over until further shipments are received.

While conditions at Columbus are serious, the Columbus Railway, Power & Light Company has a supply that will last until conditions clear up somewhat, it is believed.

Most interurban railways entering Cleveland either have suspended limited train service or will do so to conserve coal, as requested by the government.

COAL SITUATION IN KANSAS AND MISSOURI

Agreement Regarding Confiscation for Railroad Use —Cantonment Authorities Ask a Thirty-Day Surplus Supply of Coal

For the first time since the fuel administrators have had charge of the coal distribution in Kansas and Missouri there was reached on Dec. 22 a definite agreement between railroads, administrators and mine operators on the confiscation of coal for railways. It was agreed that where roads have to confiscate fuel it shall not be from the priority orders which are the emergency shipments from mines.

The situation in and around Kansas City is unique in that the Southwestern Coal Operators' Association is intrusted with the distribution of coal for the government, being first furnished with emergency orders by the administrators, who make a daily canvass through their county chairmen in the two states. In towns where dealers have coal it is ruled that no emergency exists.

Until recently some railways had confiscated coal for their own use from emergency orders. This has been stopped and all confiscated coal will be taken hereafter from other sources if railways find themselves short.

A new phase of the situation in Kansas and Missouri is that pertaining to the amount of surplus coal allowed various industries, including the government army cantonment at Camp Funston, Kan. Cantonment officers ask a thirty-day surplus, which, the Southwestern Coal Operators' Association believes, is far more than necessary and the cause of a great deal of suffering in many Kansas and Missouri towns and cities.

Priority orders give the cantonment preference, operators say, so there would be no danger of shortage there. But demand for a thirty-day surplus has called for much of the available railroad service and coal.

The operators in Kansas and Missouri, comprising the executive force carrying out the wishes of the fuel administrators, have enlisted aid of the administrators in trying to reduce the army's figures as to surplus. If they do not succeed they expect to appeal.

to Washington. Railroads leading from mining territories agreed to cut down their surplus demands.

Fuel conditions in the Southwest, which have been acute for several weeks, improved slightly in the last few days of December.

The opinion of electrical men and coal dealers in Kansas City is that the Fuel Administration "lightless night" order will be more successful if more stringent regulations are brought to bear upon the average citizen, who does not realize the importance of conservation. Companies using electric signs have been the first to observe fully the two lightless nights a week in Kansas City. They and the larger users of energy have co-operated fully with the Fuel Administration. Various small storekeepers, however, have not given full co-operation, and small users are not considering themselves as a part of the movement to conserve fuel.

It is estimated that the "lightless" nights have saved the Kansas City Light & Power Company 150 tons of coal per week. With a proper show of patriotism on the part of the public, the officials of this company say, the present arrangement will be sufficient. Otherwise more drastic action may be required by the administration to make the order successful.

ELECTRIC VEHICLE GROWTH UNDER THE CONDITIONS OF WAR

Steady Increase in Installations of Different Classes in This Country and in Europe—War Handicaps

BY A. JACKSON MARSHALL
Secretary Electric Vehicle Section, N. E. L. A.

Along with other resources, the electric vehicle has been drafted to do its part in "making the world safe for democracy." It has been estimated that approximately $36,000,000 was invested in electric commercial vehicles at the end of the year 1916.

Where England had but 150 electric trucks a little over three years ago, to-day about 1000 are in operation and many more are on order. Were it not for lack of transportation facilities these figures would be considerably greater.

While the success of the electric commercial vehicle has been marked, the success of the little electric industrial truck has been even more so. Likewise in England we find a greatly increased use of electric passenger cars.

In Norway and Sweden vast electric vehicle developments are pending and already large installations have been made which are operating in a most satisfactory manner. Were it possible to freely obtain export permits and shipping facilities to these countries, great quantities of electric vehicles of all types would be purchased and installed.

In Italy the electric vehicle has more recently been recognized somewhat and plans are now being perfected whereby the electric power generated by waterfalls will be utilized extensively in supplying the propelling force for large numbers of electric vehicles.

In far-away Australia and New Zealand, in South Africa, Japan, Mexico, South America, Denmark, France, and, in fact, all over the world, electric vehicles are now being exported in increasing numbers.

In addition to this foreign business, existent and prospective, there is the constantly growing domestic demand, which gives promise of even greater increases.

It is believed that even although we are confronted with unprecedented conditions which momentarily will throw out of balance usual modes of activity, the future holds vast possibilities for motor transportation and consequently the motor car industry will enjoy a success which will dwarf its present Aladdin-like growth. In this success the public will generously participate because of the improvements and economies which undoubtedly will be effected through the efficient mode of transportation which will come into being, and those concerns and individuals depending more or less on transportation for the success of their business would do well to promptly make plans to enjoy all the advantages which result from properly installed motor equipment. It would not be amiss to suggest that purchases of motor equipment be arranged for at the earliest time possible, for with the abnormal demands on motor manufacturing facilities, the demand will rapidly outstrip the supply.

WITHDRAWAL OF LAND USED FOR TRANSMISSION LINES

Department of the Interior Adopts the Policy of Withdrawing Land Needed for Transmission Line Right-of-Way

The Department of the Interior has made the following announcement:

In the Western States permits for the use of water-power sites and for rights of way for electrical power transmission lines are issued by the Secretary of the Interior under acts of Congress which provide for the occupation and use of lands by power companies. If, for instance, a permit were issued for a right-of-way over public lands and these lands were afterward taken up under the homestead law, a renewal of the permit could not be granted by the government, since the land would have passed into private ownership. In such a case a power company, after once having been granted a right-of-way from the government, would be compelled to obtain a renewal from all the individual landowners into whose possession the land had passed. The governmental policy has therefore been adopted of withdrawing land covering the right-of-way needed for a transmission line in order that this narrow strip of land affected may be permanently retained in government ownership. This leaves with the federal government full power to deal with permits for power-transmission lines.

CONTRACTORS' NEW PLAN TO BE MADE EFFECTIVE

Meeting of Executive Committee of National Association of Electrical Contractors and Dealers to Be in St. Louis on Jan. 22

A meeting of the executive committee of the National Association of Electrical Contractors and Dealers will be held in St. Louis on Jan. 22 to effect permanent organization under the new constitution. The new plan of organization and the broad constitution which make it effective were prepared by a committee consisting of James R. Strong, William L. Goodwin and Earnest McCleary and were adopted at the annual convention of the association in New Orleans last October. Following the action of individual states in adopting the new constitution the St. Louis meeting will represent the official end of the old constitution and organization and the beginning of the new.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Annual Meeting Held at Pittsburgh—Papers of Interest to Electrical Engineers Presented at the Third Session

The annual meeting of the American Association for the Advancement of Science was held at Pittsburgh on Dec. 27 to Jan. 2. The sessions were held in the various buildings of the Carnegie Institute of Technology and the University of Pittsburgh.

In the engineering section the first meeting was devoted chiefly to good roads, pavements, transportation by motor trucks, and similar matters. The second session was on chemical engineering and on educational problems. The third and the last session was of miscellaneous character. Among the papers were: "Measuring Telephone Transmission," R. L. Snyder, plant engineer Central District Telephone Company, Pittsburgh; "The Electrical Safety Work of the Bureau of Standards," M. G. Lloyd, associate electrical engineer Bureau of Standards, Washington; "Higher Harmonics in Polyphase Electric Systems," V. Karapetoff, professor of electrical engineering, Cornell University, Ithaca, N. Y.; "Absorption in Paraffined Paper Condensers," L. Pyle, Washington University, St. Louis; "An Interesting Case of Resonance in an Alternating-Current Circuit," H. K. Dodge, the State University of Iowa; "On Electromagnetic Induction and Relative Motion," S. J. Barnett, Ohio State University; "Eddy-Current and Hysteresis Losses in Iron at High Frequencies," C. Nusbaum, Harvard University; "Influence of a Series Spark on the Direct-Current Corona," S. F. Crooker, University of Illinois. The paper by Mr. Snyder was a symposium of problems which a telephone engineer has to solve in achieving a satisfactory transmission of speech. Mr. Lloyd's paper was an explanation of the National Electrical Safety Code published recently by the Bureau of Standards. He outlined the history of the undertaking and mentioned the various interests that had to be reconciled. The code has no legal force, but has been adopted or recommended by many state and municipal authorities, and by a few branches of the federal government. Professor Karapetoff's paper was an extension of the well-known properties of higher harmonics in a three-phase system to a symmetrical m-phase system. He showed the conditions under which an oscillating neutral may be formed in such a system, or a partial short-circuit created in a mesh-connected m-phase winding. He described the formation of traveling mmf. waves along the air-gap of an m-phase machine and finally deduced the condition under which an m-phase winding may have the N-th harmonic in space due to the n-th harmonic of the current.

The physics section held several meetings together with the American Physical Society.

The discussion on Dec. 29 was devoted to "The Relationship of Physics to the War." The speakers included Lieut. G. P. Thomson (son of Sir J. J. Thomson) and Lieut. Giorgio Abetti of the Italian mission, who gave valuable information on the organization of European scientists for war purposes. The vice-presidential address was given by Prof. Henry A. Bumstead of Yale University on the "Present Tendencies in Theoretical Physics."

The American Metric Association also met.

SECRETARY DANIELS PRAISES NAVAL CONSULTING BOARD

Loyal Sacrifice of Civilian Body Stimulates Interest in War Problems and Leads to Valuable Results

Secretary of the Navy Daniels pays a tribute to the effective work of the Naval Consulting Board in his annual report, sent to Congress recently. He says:

During the year the work of this board, organized and approved by Congress in 1915, has increased very materially in importance and volume, its meetings have been frequent, and the work of its individual members has been such in some cases as to occupy almost their entire time in the service of the government.

Some time before the active entry of this country into war the board called a special meeting to which were invited some fifty of the leading scientists and industrial managers, whose special study fitted them to advise on the methods of meeting the submarine problem. Plans were immediately made to investigate every field to develop a means of preventing destruction of vessels and of defeating the U-boat. The investigation was divided according to the experience of the different members and associated scientists, and with the co-operation and valuable assistance of the various manufacturing companies interested a highly developed system of team work has been attained and results have been accomplished not dreamed of at the beginning of the war.

The services of the board were offered to the Council of National Defense and accepted by that body for the investigation of all inventions submitted. Its services were also accepted by the War Department in an advisory capacity.

Valuable assistance has been rendered merchant shipping by the board's activities. Through its initiative, counsel and work the United States Shipping Board formed its ship-protection committee, taking over the study of the protection of merchant ships, and to this committee was detailed one of the consulting board's most experienced members qualified in shipbuilding and with sea experience. In this field the board's work has resulted in materially reducing the shipping risk, with a consequent lowering of marine insurance rates.

Not the least result of its work has been the stimulation of interest throughout the country in the problems brought up by the war by the general invitation to submit ideas for investigation. Early in the calendar year 1917 this interest manifested itself in the receipt of thousands of ideas weekly, and to care for this the department's connecting office has been greatly enlarged, the office of the board in New York has been organized on a working basis with a large force, and the whole movement has received the approval and hearty assistance of the great national engineering societies. The president of the board, Thomas A. Edison, has been giving his entire time to the work of the board in the service of his country, and has called to his assistance a capable staff who are working diligently upon naval problems.

With war conditions increasing the need for labor and building materials, it was believed to be a wise policy to defer for a time the building of the new experimental and research laboratory. Such experiments as have been warranted have been made in private laboratories generously offered and at the Bureau of Standards. The need for this establishment, however, is more clearly shown than ever, and its support is urgently advised.

The valuable results obtained by the work of this board are of too confidential a nature to make them the subject of a public document. The members have given freely of their time and scientific ability to the service of the nation and have earned the gratitude of all who know their unselfish and patriotic service. I wish to express my sense of obligation for the cheerful co-operation, wise counsel, loyal devotion and personal sacrifice which have characterized the membership of the board of distinguished civilians who responded, long before war was declared, to the selective draft with all the enthusiasm and efficiency of youthful volunteers.

Arkansas Light & Power Company's New Office.—The general office of the Arkansas Light & Power Company is now in Pine Bluff, Ark.

Max Thelen on Public Utility Problems.—Max Thelen, president California Railroad Commission, has inaugurated the University of California extension course on public utility problems. This university extension course is open to all and is directed especially to lawyers, bankers, officials and employees of public utilities, city and county officials and others particularly interested in problems of regulation of public service corporations and in the way in which they are being worked out by the commissions.

Adirondack Power Consolidation Plan.—A new plan has been issued for consolidation of the properties of the Adirondack Electric Power Corporation, Schenectady Illuminating Company, Mohawk Gas Company, Schenectady Power Company, East Creek Electric Light & Power Company and Edison Electric Light & Power Company of Amsterdam. It is a substitute for the plan dated Jan. 27, 1917, and is subject to approval by the New York Public Service Commission, Second District. If not consummated during 1918, depositors will have the right to withdraw their stock on or after Dec. 31, 1918. If the unification is completed there would be outstanding $11,500,000 of 5 per cent bonds, $4,300,000 of 6 per cent preferred stock, and $9,500,000 common stock. For the year ended Oct. 31, 1917, adequate gross earnings for the combined group were $3,399,734, and net earnings $1,113,611. Directors unanimously approve the plan, and urge stockholders to deposit their stock with the New England Trust Company, Boston.

Lighting in St. Joseph, Mo.—A proposition of the St. Joseph (Mo.) Railway, Light, Heat & Power Company to furnish energy for the entire street-lighting system of St. Joseph at the rate of 1½ cents per kilowatt-hour for the arc lights and the boulevard lights and $37.50 a standard for the "white way" was made to the City Council recently. A suggestion that the company take over only the "white way" and the boulevard system at the figures offered was declined by J. H. Van Brunt and H. C. Porter, representing the company, who said that they could not make such a price for so small a contract. The prices offered, they said, could be made only in case the company received the contract to light the entire city. The company offers to bind itself to the contract for ten years but to allow the city to terminate the contract at any time on six months' notice and the purchase of the equipment actually in use. The company figures that the saving in the matter of arc lights would be about $10,000, while another saving would be effected by the free use of the company poles in the extensions that might be made for additional lights. The expense of equipment for the boulevards alone would cost $10,000, and equipment for all the street lighting would cost $20,000.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Opportunities to Serve the Nation.—The army and navy staff departments continue to demand men of engineering experience, especially in industrial lines. At present the outlook is that this demand will continue throughout the period of the war. In calling attention to this the United States Public Service Reserve, Washington (where records of men willing to serve when called will be kept on file), points out that a man of engineering experience has a rare combination of opportunities open to him which are not open to the average patriotic American, as follows: (1) To serve the country in his most effective capacity; (2) to keep in touch with his own profession, with the result that his patriotic service will not have caused him to become rusty by the time peace returns; (3) to become a commissioned officer and receive much better pay than the average man who has wholly subordinated personal interests, and now works for the national good; (4) to perform his service usually in America.

Free Class for Radio Operators at Stevens Institute.—A free evening class to train men as radio operators for the Signal Corps will be started soon by the Stevens Institute of Technology, Hoboken, N. J. Those who actually expect to be called to the colors will be admitted if prompt application is made to Prof. L. A. Hazeltine, head of the department of electrical engineering, under whose supervision the course will be conducted. The definite object of the course, which will require four evenings weekly, is to develop radio or buzzer operators to send a minimum of twenty words per minute. Upon finishing the course, which requires about 200 hours, less for some and more for others, a certificate of attainment will be given. The course is offered specifically for those who desire to enter a cantonment trained and ready to do a specific job. Washington authorities state that "drafted men who attain the required proficiency are practically certain of rapid promotion and increased pay in the army. The rank of corporal and sergeant, with $36 to $51 a month, awaits the majority of men thus trained, and in proportion as a man so instructed shows his ability and interest promotion lies ahead of him to the position of master signal electrician, with $81 a month."

Another Engineer Regiment to Be Organized.—The co-operation of the American Institute of Electrical Engineers has been requested in the organization of the Thirty-seventh Engineers (electrical mechanical). This regiment will be organized at Fort Myer, Va., for electrical installation, operation and maintenance in France. The officers for the regiment are available from the roster of the Engineer Reserve Corps. The classifications which it is desired to include in the enlisted personnel of the regiment are stationary engineers, motor-truck drivers, electricians, cable splicers, linemen, expert test men, wiremen, armature winders, machinists, pipe fitters, carpenters, blacksmiths, handy men and cooks. The opportunity to try for promotion as non-commissioned officers will be afforded to every enlisted man, as the regiment will be entirely new. The organization will be military as far as training, drills, discipline, etc., is concerned, as it is found that the health and efficiency of the men is in this way most readily maintained. Persons desiring to join the Thirty-seventh Engineers should apply for forms to the commanding officer, Thirty-seventh Engineers, Room 195, War Department, Washington, D. C. No enlistments will be received except by authority of this officer. Men in the draft age but not yet called may also make application.

"Material Costs Have Reached Their Maximum."—In a statement to stockholders, President Hanson P. Lathrop of the American Light & Traction Company says: "Your company is still passing through a period of high operating costs—prevalent in all lines of business. It is felt, however, that material costs have reached their maximum. Recent purchases show recessions from the high point. The period of high material costs for this company began in the midwinter season of 1916-17, and when that period of comparison is reached it is confidently expected that the usual satisfactory increases in net earnings may again be looked for. The enormous increase in gross business is much the largest in the history of the company, and with one exception the net earnings for the twelve months ended Sept. 30, 1917, were larger than for any corresponding period. Some stockholders have felt considerable trepidation as to the effect of the taxes imposed by the war revenue bill. The increase in the normal tax and the so-called excess profits provision do not apply to your company, holding companies being exempt from these particular provisions. The subsidiary companies will all be subject to the increase in the normal tax, but only four will be subject to the excess profits tax. These taxes, however, have been, to a large extent, taken care of by anticipatory charges made during the current year. When considering the large increase in operating costs in connection with the decrease in net earnings, the conclusions are not wholly unfavorable, but speak well for the future, when operating costs are more nearly normal. For the twelve months ended Sept. 30, 1917, net earnings show a decrease of $529,153, while increased material and labor cost for the year was: Coal and oil, $607,700; labor, $262,400; labor and material, total, $870,100; taxes, $553,300; total, $1,423,400. The total increase in gross business of the subsidiary companies for the above period is $2,077,300.

D. J. ANGUS

D. J. Angus, who recently purchased an interest in and associated himself with the Esterline Company of Indianapolis, Ind., as treasurer, takes the responsibility of the engineering department and of the design and development of new lines of instruments and apparatus. Prior to his acquiring an interest in the Esterline Company Mr. Angus was associated with J. W. Esterline in a large consulting engineering business which has been developed in the Middle West. Mr. Angus began his career as an engineer in the construction department of the Milwaukee Electric Railway & Light Company, later handling electric construction for the Wisconsin Telephone Company and also the Semet Solvay Process Company of Milwaukee. He spent the years 1906 and 1907 in special work and investigation at the University of Wisconsin, and for several years following he was identified with some of the large electrical developments in the States of Michigan and Wisconsin. In 1909 he again took up the study of special electrical subjects, this time at the engineering department of the Michigan Agricultural College. In 1910 he became associated with Mr. Esterline in a consulting engineer practice embracing the design, construction and operation of power and industrial plants and the design and development of new equipment and processes. Although yet a comparatively young man, Mr. Angus has taken part in some of the pioneering work in the development of the industry. In 1909 he did original work in the testing of transmission-line insulators with high-frequency currents and designed and built commercial apparatus embodying the application of this method of testing. He was one of the early advocates of charging for demand on a measured kilovolt-ampere basis, and as early as 1911 he made a commercially successful application of this system of charging. Furthermore, he designed the world's largest electric meter for the Mississippi River Power Company at Keokuk.

Major John Coffee Hays, formerly president of the Mount Whitney Power & Electric Company, Visalia, Cal., is in charge of the newly created utilities department at Camp Lewis, Wash.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

Earl G. Burwell has resigned as salesman for the Colorado Springs Light, Heat & Power Company to become commercial manager of the Wyoming Electric Company at Casper, Wyo. Mr. Burwell, prior to his association with the Colorado Springs company, was cashier of the Birmingham Railway, Light & Power Company.

W. H. Frost has joined the engineering staff of the United Gas & Electric Engineering Corporation as assistant electrical engineer. For a number of years Mr. Frost has been a member of the engineering department of the New York Edison Company, where he has had supervision of the design and construction of new substations.

Capt. Edwin W. Moore, president of the Bare Wire Company and chief senior aide to Major-General John F. O'Ryan, commanding the Twenty-seventh Division, United States Army, has returned to Spartanburg, S. C., after having been in New York for some time in conference with the Major-General, who has just returned from France. Captain Moore has been identified with the wire and cable industry for a number of years and has been a prominent figure at trade and contractors' conventions.

E. W. MOORE

Harry Engle, for a number of years connected with the electric-lighting business in Youngstown with various concerns, and until recently with the Youngstown Heating Company, is now with the Mahoning & Shenango Railway & Light Company in an executive capacity, it is announced, and has been associated with the company since Nov. 1. Mr. Engle was formerly associated with the Mahoning County Light Company as secretary.

G. L. KNIGHT

G. Laurence Knight, head of the engineering department of the Edison Electric Illuminating Company of Brooklyn, was elected president of the Brooklyn Engineers' Club at the annual meeting held on Dec. 20. Mr. Knight, who was born on Feb. 20, 1878, received his electrical engineering education at Drexel Institute, from which he was graduated in 1900. After graduation he entered the employ of the Philadelphia Electric Company as a switchboard operator, and in the following year he took a position as an electrical draftsman with the United States Navy. In 1902 he became mechanical draftsman for the New York Edison Company, resigning in the same year to become manager of the Walker Electric Company, which was engaged in the manufacture of switchboards. From 1903 to 1905 he was chief draftsman for the New York Edison Company at the Waterside station, and from 1905 to 1908 he occupied the same post with the Brooklyn Edison Company. He was appointed designing engineer for the Brooklyn company in 1908 and is now head of the engineering department. Besides being a fellow of the American Institute of Electrical Engineers, Mr. Knight has long been a member of the standards committee and the electrical apparatus committee of the N. E. L. A., and for the last two years he has been chairman of the latter committee.

Obituary

John Henry Goehst died Jan. 1. He was the oldest employee of the Commonwealth Edison Company in length of service, having been construction superintendent for many years. Mr. Goehst had been with the company and its predecessors since 1882. He was a pioneer in the electrical industry, having been associated in early days with Luther Steiringer, Ward Leonard and others. He was greatly interested in the early history of the industry, was chairman of the history committee of the Commonwealth Edison Company and held many positions of influence in the company. Mr. Goehst also was president of the Federal Sign System, Electric. He had been long ill.

New Mexico Electrical Association.—The next meeting of this association will be held at Silver City, N. M., Feb. 11-13.

Northern White Cedar Association.—The twenty-second annual meeting of the Northern White Cedar Association will be held at the Hotel Radisson, Minneapolis, Minn., on Jan. 22 and 23. Norman E. Boucher of Minneapolis, Minn., is secretary of the association.

Philadelphia Section of the Association of Iron and Steel Electrical Engineers.—This section will hold a meeting on Jan. 5 (to-day), at which J. C. Reed and Merwyn J. Hocker, electrical engineers of the Bethlehem Steel Company, will present and illustrate a paper on "Electrically Operated Bridges."

Officers' Electrical Section, W. S. E.—The nominating committee of the Electrical Section of the Western Society of Engineers has selected the following ticket for officers for the ensuing year: Chairman, E. N. Lake; vice-chairman, James A. Cravath; executive committee, Charles H. Norwood and Ernest Lunn.

Institute of Radio Engineers.—A meeting of the Institute of Radio Engineers was held Jan. 2, in the Engineering Societies Building, New York City. At this meeting Dr. Albert W. Hull of the General Electric Company presented a paper on the dynatron, an extension of the hot-cathode electron relay.

Pittsburgh Societies to Hold Joint Meeting.—The Pittsburgh Section of the Association of Iron and Steel Electrical Engineers will hold a joint meeting with the American Institute of Electrical Engineers in January. Papers will be presented on the generation, distribution and consumption of power as well as on power-factor correction.

The Engineering Society of York.—At the annual meeting of the Engineering Society of York, Pa., held recently, the following officers were elected for the ensuing year: President, James Rudisill; vice-president, Chauncey D. Bond; secretary, M. Haller Frey, Polack Building; treasurer, Harold A. Russell. The directors are George A. Jessop, Charles L. Berger and Howard J. Longnecker.

Three Hundred and Thirty-sixth Institute Meeting in Boston, New York and Chicago.—The three hundred and thirty-sixth meeting of the American Institute of Electrical Engineers will be an intersectional meeting held in Boston Jan. 8, New York Jan. 11 and Chicago Jan. 14. The same paper will be presented and discussed at the three places. This paper is entitled "Effects of War Conditions on the Cost and Quality of Electric Service." It is by Lynn S. Goodman and William B. Jackson, and is given under the auspices of the committee on economics of electric service. The paper will be presented at the New York meeting by Mr. Goodman and at the Boston and Chicago meetings by Mr. Jackson. Nonmembers of the Institute who are interested in this subject are cordially invited to attend and take part in the meeting.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 79 of this number.

Future Section Meetings of the A. I. E. E.—The following A. I. E. E. section meetings are scheduled for January: Ithaca, Jan. 18, "Modern Transmission Line Practice"; Lynn, Jan. 9, "Steel Foundry Practice"; Philadelphia, Jan. 14, "Specifications Covering the Construction at Crossings or Overhead Lines of Public Utilities"; Pittsfield, Jan. 17, "Motor Drive in Textile Mills," S. B. Paine; Portland, Jan. 8, "Powdered Coal for Fuel"; Feb. 8, "Electric Smelting of Iron"; San Francisco, Jan. 25, "Corona at High Altitude"; St. Louis, Jan. 23, "Electrical Equipment of New *Post-Despatch* Building."

St. Louis Jovian League Holds Christmas Feature Meeting.—The St. Louis Jovian League held a very interesting meeting at the American Annex Hotel Tuesday, Dec. 18, in which women relatives and friends of the members participated. As it was the last meeting of the year, it was designated a "Christmas feature meeting." George Platt Knox, assistant superintendent of public schools, was the speaker of the occasion and delivered a lecture, illustrated with slide pictures, entitled "Jerusalem to Bethlehem." The meeting was under the auspices of the Allis-Chalmers Manufacturing Company and was presided over by C. L. Orth, district manager of the company, assisted by Herman Spoehrer, treasurer of the Union Electric Light & Power Company. Among the guests present were Mr. and Mrs. Leonard Matthews, father and mother of Past Jupiter W. N. Matthews, president of the league.

December Meeting of Kansas City Jovians.—The Jovian Electric League of Kansas City held its second successful monthly meeting of the season at the Muehlebach Hotel, Dec. 21, with sixty in attendance. A service flag, with eleven stars, was presented by E. L. Foutch. The honor roll contains the names of P. J. Kealy, president of the Kansas City Railways Company, and K. D. Klemm, president of the Kansas City, Kaw Valley & Western Railway, the former a colonel of infantry, the latter a colonel of artillery. W. S. Woodland, formerly in charge of safety work for the railways company, received a commission at Fort Sheridan as lieutenant of aviation. The other Jovians on the roll are Charles R. Born, R. P. Bailey, R. H. Cowdry, Jr., F. W. Gary, A. E. Herzberg, W. E. Saylor, C. H. Taylor and L. H. Shoemaker. Captain R. W. Simmie, formerly at the front, now in charge of British recruiting at Kansas City, spoke at the luncheon. Major Norton and Lieutenant Robinson of the Engineers' Corps, Fort Leavenworth, were among the guests.

Annual Meeting of the American Metric Association.—The annual meeting of the American Metric Association was held at Pittsburgh Dec. 28 and 29. Most of the sessions were held at the University of Pittsburgh, the first two sessions in conjunction with the social and economic sections of the American Association for the Advancement of Science. The association is working for the most effective co-operation between the United States government and our allies. At this time, when the army and navy are making extensive and increasing use of the metric weights and measures, comes the desire on the part of those in the service to familiarize themselves with the best and most effective methods of applying these units to their particular work.

Relation of Science and Engineering to the War.—The extent to which men of pure science and men of applied science have aided the United States in prosecuting the war was told at length in a paper presented by Prof. Harvey Lemon of Chicago for Major R. A. Milliken, executive officer of the National Research Council, Washington, D. C., before a joint meeting of the electrical organizations of Chicago, Dec. 27. Major Milliken was prevented from delivering the paper himself by an imperative recall to Washington. The author expressed the opinion that the scientist engaged in what is only indirect war work is just as useful and as heroic as the one who is engaged directly in war service. He emphasized the point that it is foolish for engineers and scientists to flock to Washington to learn what they can do to aid the government. Lists of experts in all lines are available at Washington, and when men are needed they are requested to take up the work. Those who are still in civil life should continue to prosecute their work as efficiently as possible. Comments on the direct contribution of science to the war brought out that many problems have already been solved. Advancement has been made in submarine detection. Methods of locating guns by means of sound waves are now so accurate that guns within a radius of 5 miles (8 km.) can be located within 50 ft. (15.2 m.). In a recent battle no less than sixty German guns were located and destroyed through the use of this system. Scientists of the United States have made large strides in gas offense and defense. The scientific mission from abroad advanced the United States a full two months in its scientific war preparations. What is true of the realm of pure science is also true of applied science and engineering. Here also a large contribution has been made. Major Milliken gave quite a complete review of the organization and the eminent personnel of the National Research Council. He also stated that its aim was to give American science an opportunity to assist in winning the war. In closing the author expressed the fervent hope that the work of scientists and engineers in the war would fill the chasm which has been allowed to deepen between physics and engineering. The future of America is linked with science.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Review of Coal Costs.—In the decision of the New Jersey Board of Public Utility Commissioners on the application of the Bridgeton Electric Company to increase rates, mentioned previously in the ELECTRICAL WORLD, the testimony showing the following costs of coal at the power station was reviewed: 1904, $3.40; 1905, $3.42; 1906, $3.29; 1907, $3.32; 1908, $3.37; 1909, $3.45; 1910, $3.30; 1911, $3.31; 1912, $3.35; 1913, $3.33; 1914, $3.60; 1915, $3.53; 1916, $3.70. Reviewing the testimony on coal costs, the commission said: "It was testified that contracts had been made for the supply of coal to Bridgeton, but that no coal had been received under such contracts for some time past, and the prices paid have varied considerably. The average price at the mine for the coal sent to Bridgeton in the first five months of 1917 was $5.16. In addition to the higher price for coal, the cost of delivering this coal at Bridgeton from the mine, including the delivery in power plant, was $2.05. During May, 1917, the price paid for coal was $6.25 at the mine, plus $2.05 for freight and delivery. The last price, paid about three weeks prior to the date of the hearing, was $5.65 plus cost of freight and delivery. The increase in the cost of coal results in a material increase in the total cost of furnishing electric service, and might result eventually in a deterioration in the character of service. The testimony submitted at the hearing showed that no more than a fair return was being obtained on the invested capital of the electric service company."

Indiana Fixes Electric Service Standards.—The Indiana Public Service Commission has adopted new standards for electric utilities. They were worked out after many conferences held by Harry O. Garman, chief engineer of the commission, following action by the commission authorizing uniform standards for electric utilities. The standards have to do with records and reports, meters, meter-testing equipment and facilities, meter accuracy, information for consumers, adjustment of bills for meter error, incandescent lighting, deposits by customers, operation and maintenance, standard frequency, standard voltage and permissible voltage variation, voltage surveys and records, interruptions of service, station instruments, station records, accidents, grounding of low-potential circuits, extension of lines, pole identification and many other topics. Conferences with J. Franklin Meyer, associate physicist of the United States Bureau of Standards, and frequent reference to similar standards and similar work of such commissions as those in New York, New Jersey, Illinois, Wisconsin, California and Kansas, were held before the engineering staff of the Indiana commission was ready to submit the proposed standards to the managers of private and municipal utilities in Indiana for suggestions from them. The purpose is to provide uniform service and to give the small utility the advantage of big utility practice wherever possible. "The big utilities do not need such standardization to such an extent as the smaller plants," said Mr. Garman. "Under these new standards a consumer may know when he is getting good service and the utility managers may know when the utility is delivering good service."

Sale of Property.—In a decision on the application of the Marianna Light, Heat & Power Company for approval of the transfer of its property and franchise rights to the Union Coal & Coke Company the Pennsylvania Public Service Commission holds that where a light, heat and power company purchased its power from a company which subsequently went into the hands of receivers and where by a receivers' sale all possibility of securing power from said company ceased the commission, with much reluctance, will permit the light, heat and power company to sell its facilities to the purchaser of the property which was sold at the receivers' sale.

Requirement of Extensions.—The Pennsylvania Public Service Commission in deciding the complaint of Fred Palmer-Poroner vs. the Consumers' Gas Company of Reading concludes that a utility cannot under all circumstances refuse to make an extension of its service until the same becomes compensatory. A public utility engaged in the business of the respondent is required to furnish service in all parts of the municipality in which it is operating whenever a reasonable demand or prospect for such service is shown to exist. The service cannot be restricted to sections or neighborhoods from which the larger returns will flow, but must also be extended to localities where the business will not be immediately profitable or perhaps even self-sustaining until a later period in the growth and development of the community. Where circumstances so shaped the development of the utility's business that small central blocks or areas containing desirable homes and sites, particularly in a large city, have been supplied with service, it is only a matter of simple justice that the residents on any such block, if they so desire, should be accorded the same privileges and conveniences that their neighbors in adjacent streets are permitted to enjoy. But where there is no demand for service from the residents themselves, and there is no prospect of securing at present more than six small consumers who will use gas for fuel during the summer only, the commission will not compel the gas company to install a new gas main 580 ft. in length at a cost of approximately $800 until it can be shown by evidence that the persons who are directly affected desire the service.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Power of Commission to Authorize Securities.—By law a public utility has the right to issue whatever bonds and stock may be necessary to carry out corporate powers, acquire property, construct and extend facilities and maintain and improve service, and the Public Utilities Commission has no general discretion to refuse to certify such securities, the Supreme Court of Kansas held (167 P. 1138). The Public Utilities Commission has full power to ascertain the truth of all statements made by a public utility in its application for a certificate validating a bond and stock issue, including the required statement that the capital stock to be secured is necessary for a specified statutory purpose and will be used therefor. The word "necessary" as used in the statute means needful under all the conditions attending the enterprise. The Public Utilities Commission has authority to require proof of need for the issuance of bonds and stock beyond the proof afforded by the verified application.

Right to Operate Under Terms of Charter.—Where an electric light and power company received a charter authorizing it to maintain and operate its plant and dispose of energy, providing that it could not exercise any of its powers within the limits of any town, village or city without the consent of the local authorities, the company could not, under a private grant, provide street-lighting service and supply energy for private consumption in a town without consent of the town board, it was held by the Supreme Court, Appellate Division, of New York (167 N. Y. S. 486) in Oneonta Light & Power Company vs. the Public Service Commission, Second District. Although an electric light and power company had a private grant of way to construct its lines, the Public Service Commission, under the section of the Public Service Commissions law requiring the consent of the commission to construction work, had the power to supervise the construction of its lines. The Legislature has the power to prescribe the conditions upon which a corporation of the State may operate. In view of the Public Service Commissions law defining the term "electric plant" to include all realty, fixtures and personalty used in connection with generation, transmission, distribution or sale of electricity for light, heat or power, an electric company attempting under private grant to dispose of energy to private consumers is "beginning construction of an electric plant" within the law giving the commission authority to supervise construction.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

ELECTRICAL TRADE SHOWS STRENGTH IN FIRST WAR YEAR

Review of Conditions Affecting Production, Distribution and Sale of Electrical Products During 1917

STARTING with a heritage from 1916 of a quarter of a billion dollars of unfilled orders, the electrical manufacturing industry in 1917 far exceeded the record set in 1916 both in billings and bookings. Although the country was engaged in war nine out of the twelve months of the year, the industry has shown on the whole no diminution of output but rather a very considerable increase. Careful and conservative estimates place the 1917 billings of electrical manufacturers in the near neighborhood of $750,000,000, while unfilled orders at the close of the year were certainly not less than $300,000,000. Thus the 1917 electrical manufacturing industry can be said to have passed the billion-dollar mark.

EVIDENCES OF BETTER BUSINESS POLICIES

In 1916 the electrical trade, experiencing its first real sellers' market, was for the most part at a loss as to just what to do. There was no precedent—no guide to follow. However, as every one became more accustomed to prevailing conditions a more staple state of affairs emerged. Consequently in the year just closed the industry grasped the opportunity to straighten out many tangles of sales custom, distribution and production. The natural result has been that the industry has closed the year with a better state of competition existing.

Many old practices, including that of protective orders and of price-increase announcements, have seen the beginning of the end. Closer thought has been given to the matter of credits and collections than ever before. The old question of the cash discount has been under fire considerably and, while not settled, is better understood. Besides, there has been an unmistakable tendency among manufacturers in the last half year to hold customers strictly to the "spirit of the law" in discounting bills. Charging interest on past-due accounts has been urged but is not meeting as yet with much enthusiasm.

Trade acceptances are in greater evidence in the trade, and there is a decided movement, particularly among jobbers, to institute a more general use of this credit system.

As a further evidence of a tendency toward better merchandising in the trade, there has been noticed throughout the year a marked desire, particularly on the part of the jobber, to help the retailer become a better business man. The credit men have gone on record as favoring the use of a simple accounting system for the retailer. A system of balanced stocks has been suggested. More helpful attention is being given to the "moral-risk" customer. Greater study has been given to the subject of dealer helps. In all there has been more real action in elevating the retailer than ever before.

Besides, the jobber has been cleaning house of poor business methods. The jobber is paying more attention to business and is not so quick to take trade without a fair and reasonable profit. There has been less price cutting during the past year than ever before. Buying has been more careful and less speculation has been in evidence.

UPWARD TENDENCY OF PRICES

Prices, except for raw materials, had an upward tendency throughout the year, but not to such a marked degree as in 1916. Heating appliances advanced every few months. Glass and porcelain products increased, as did many other staples. As the year closed announcement was made of the first increase in the price of incandescent lamps. On the other hand, certain products, including wire, were lower in price as the year came to a close. In May, for the first time in the history of the industry, the ELECTRICAL WORLD started publishing current market prices, and it has continued this work weekly ever since.

METAL PRICES LOWER

In the raw-materials market the government price-fixing program, which found expression in September in lowering the price of copper and steel products, has been the dominating factor. Metal prices, except for tin and nickel, were much lower in December than in January. Following is a comparison of metal prices in New York during the first and last weeks of the year:

	Jan. 3	Dec. 24
	£ s d	£ s d
Copper:		
London, standard spot	133 10 0	110 0 0
Prime Lake	29.00 to 29.50*	Govt. price 23.50
Electrolytic	28.00 to 29.00*	Govt. price 23.50
Casting	27.00 to 28.00*	Govt. price 23.50
Wire base	36.00 to 38.00	27.00*
Lead, trust price	7.50	6.25
Nickel, ingot	50.00	50.00
Sheet zinc, f.o.b. smelter	21.00	19.00
Spelter, spot	9.67½ to 9.92½	7.67½
Tin, Straits	42.75*	85.00†
Aluminum, 98 to 99 per cent.	55.00 to 58.00*	34.00 to 36.00
Heavy copper and wire	24.00 to 25.00*	22.00 to 22.50
Brass, heavy	14.50 to 15.50*	14.00 to 15.00
Brass, light	10.50 to 11.00*	9.50 to 10.50
Lead, heavy	6.50 to 6.62½*	5.75 to 5.87½
Zinc, old scrap	6.00 to 6.25*	5.00 to 5.50

*Nominal. †None offering.

While business in electrical goods both by manufacturers and wholesale distributers was larger in 1917 than ever before, it was of a very different nature than is the case in normal times. In the past utilities, electric street railway and telephone, and building construction had been the principal markets. To-day the government and industry control the situation. Because of their inability to borrow money except at prohibitive rates utilities have almost entirely withdrawn from the market. In fact, in some instances cancellations of undelivered orders are being requested. Except for factory building, there has been a very heavy curtailment of new construction. Hotels, churches, office buildings, apartment houses, etc., have wherever possible been held over until more satisfactory times. Contractors as a result have not been busy and fixture people have been experiencing a business far below normal.

There have been few new developments of products. Research laboratories have been kept busy largely on government work. There have been a number of modifications of equipment replacing expensive material with less expensive, such as steel guards for brass fans. Electric furnace development, however, has been very large and rapid and many new models were brought out during the year.

STANDARDIZATION PROGRESS

There was during the year considerable progress in standardization, particularly in appliances. About 90 per cent of the 1917 fan production had steel guards and were furnished with cord and plug. Toward the end of the year a standard length of cord—8 ft.—was decided upon. Four blades except in large sizes is now standard, and the old name "desk and bracket" has given way to "non-oscillating." Steps were taken during the year also to standardize appliance plugs. Besides, the committee on trade literature of the Associated Manufacturers of Elec-

trical Supplies has recommended the standard catalog size of 8 in. by 10½ in.

THE PROBLEM OF LABOR

Two of the greatest difficulties that the trade has had to contend with during the past year have been labor shortage and transportation congestion. Both have handicapped production and deliveries. In the electrical manufacturing industry there were fewer strikes and less serious ones than during 1916. Labor, however, was still roving. There was a serious shortage throughout the year in mechanics and similar skilled labor and in unskilled labor. Of the other large class of labor, however, statistics show a growing percentage of unemployed. After the war broke out the labor situation became worse. First, the army and navy took almost 10 per cent of the male labor in the electrical industry and second the government, through cantonment construction and the shipyards, put a severe strain on labor by offering an opportunity to earn the largest wages on record in the United States for that kind of labor. In addition, the female labor supply apparently became less. A large amount of female labor is employed in electrical manufacturing, and the scarcity has hampered production considerably. Higher wages were paid during the year and high-cost-of-living bonuses were given by manufacturers rather generally.

The only ray of hope in the labor market came in the winter months early in the year, when the closing of plants that had completed war contracts for Russia and other warring nations released large numbers of skilled workmen. The entrance of the United States into the war, however, made the demand for this kind of labor more acute than ever.

On Sept. 1 the child-labor law guarantee was demanded of dealers as well as manufacturers.

TRANSPORTATION DIFFICULTIES

Transportation congestion as the year opened was very bad, growing worse until the Eastern seaboard in March was in an almost hopeless condition. This was a great handicap to both buyers and sellers in deliveries already very long. Embargoes were placed on freight for export shipment and a lot of other material eastward bound. The lack of tonnage for export caused docks and warehouses to be filled to capacity, rendering the removal of goods still more difficult. During the summer months, however, the shortage in freight cars was decreased by about a third, but by September it was worse than ever. The transportation situation became still more serious until the government, feeling that private operation could not solve the problem, even with transportation priority orders, stepped in a few days prior to the end of the year and took over the control of all roads under Secretary McAdoo.

CONDITIONS IN LAMP MARKET

Demands for materials, as before stated, were particularly large. Lamp manufacturers for many months found it impossible to keep up with orders. Shortages developed in every section of the country, being particularly acute in the Far West and in New England. Every effort was made to cope with the situation, and by the late fall months the manufacturers advised the ELECTRICAL WORLD that they had just been able to lay in local stocks in most standard sizes but still were behind in miniatures. During the year central stations were placed on the agency plan for Mazda lamps. Under the licensing arrangement the importation of tungsten lamps became illegal.

FAN STOCKS AGAIN DEPLETED

Wholesale fan stocks were sold out earlier this year than ever before, and as in 1916 the season closed with the market practically void of every kind of fan stock. The great hot wave in the first week in August ate up almost all fans available.

Although prices advanced at regular intervals during the year on heating appliances, the output established a new record. In some instances manufacturers announced the increases prior to their going into effect, with the result that buying was greatly stimulated. In November the merger of the Hotpoint, Hughes and General Electric domestic heating appliance businesses into the Edison Electric Appliance Company was announced.

TURBINE PRODUCTION SOLD OUT EARLY

Turbine production for 1917 was early sold out, and by the first of June 1918 and 1919 production for larger sizes had been booked, with orders running to 1920. The largest single order on record, 200,000 kw. in turbines, was placed in May.

Transformers and motors in large sizes were particularly hard to obtain after the middle of the year. Production has been booked far ahead. In the early fall it was estimated by good authority that manufacturers were 150,000 motors behind orders.

The second-hand market flourished as never before during the year. High prices prevailed. Dealers found it very difficult to secure equipment. Much of this equipment was ordered only until such time as new goods could be delivered. In this way some machines were sold and resold many times during the year. The government frequently found the second-hand men to be very valuable when especially quick deliveries were needed.

WAR HEIGHTENS DEMANDS FOR MANY PRODUCTS

The declaration in the first week in April of the existence of a state of war opened a large demand for many electrical products. The sale of floodlamps for protective purposes increased in a few weeks 500 per cent. This demand, however, was soon satisfied and sales then dropped off. Flashlamp manufacturers were soon swamped with orders owing to the military and export demand.

The need for greater production and for efficiency in labor and saving in time brought unparalleled sales of electric industrial trucks. Manufacturers are working at capacity production and are booked many months ahead.

Furthermore, the direct government demand for cantonments and shipyards was large and, besides, it was almost entirely for immediate shipment. For a time it looked as though the government buying would entirely disarrange the manufacturing of the country, but the producers quickly took steps to co-operate with the government in the matter of placing contracts. Committees of wire and other device manufacturers took the government orders and apportioned them among the different factories so that none were burdened more than others. As a result the government received a better price and better deliveries and the industry was upset as little as possible.

In order that the government and factories working on government contracts might obtain electrical goods as quickly as possible the priority plan was introduced. This worked all right for a while, but in the late fall it became evident that the amount of priority orders was fast approaching the entire production. Steps, however, have been taken to remedy this and to make sure that only bona-fide "war" orders receive priority.

EXPORTS OVER $50,000,000

Exports increased considerably during the year up to the fall months. In March electrical exports for the first time passed the five-million-dollar mark. For the fiscal year closed June 30, 1917, exports were $52,158,773. Owing to the falling off in the last few months of the year it is very doubtful if the exports for the calendar year 1917 surpassed the above figure. Foreign demand was larger than could be handled. An interesting sidelight is the growing export demand for electric heating and cooking appliances brought about by the high price of coal abroad.

Collections were in general particularly high during the year. January and February collections set new high records. The entrance of the United States into the war, however, caused accounts to be settled with less freedom for a month or two. The two Liberty loans brought some slackening in collections, but nothing very serious in the electrical industry.

Thus the manufacturing industry and the trade closed the year in a very satisfactory and strong position. Jobbers' stocks have been pared down and unfilled orders are large. Competition is better and the business is generally on a more sane basis. The war has not lessened the business of either jobber or manufacturer, merely changed it.

WIRE PRODUCER EXPECTS DEMAND TO BE LESSENED

Central Stations and Trade Generally Are Urged to Watch the Market More Closely than They Have Done Heretofore

Adverting to the subject of wire base the other day, the head of one of the important departments of a prominent manufacturer of electrical apparatus, equipment, supplies and accessories said to a representative of the ELECTRICAL WORLD: "Conditions affecting the status of wire base should be better known and understood by the trade. If a buyer should appear, it is my judgment the wire men would quote him all sorts of prices. I figure that the nominal price of base is 34 cents, but we are naming 30 cents. I will admit that the drawer of wire, after paying, say, 24.67½ cents, unless he bought in larger than car lots, when 23.50 cents would be the price, estimates that it costs him about 4 cents between the copper producer and the running through his mill. The cost of finished product is arranged on such basis.

"Now, it looks to me as if there would be a falling off in the demand for copper next year, which may be accounted for on the ground that the requirements of central stations and public utilities will be less. The central stations are already taking precautions to protect themselves by refusing to make extensions unless the cost of the work is advanced. Industrial customers in the great manufacturing districts along the Atlantic seaboard have been notified that increased light or energy will be furnished only when they are engaged in governmental work. In these cases an official certificate to this effect must be forthcoming, otherwise the application is peremptorily refused. The disposition of the central station is to take on no further load.

"All this means that the demand for wire will be less than it has been for some time. Consequently I look for easier conditions—in deliveries and quantity, if not in price—than have prevailed for some time. The trade should therefore keep itself in closer touch with the market and look and inquire for inside information. Jobbers and dealers would then be in a better position to figure more understandingly on their requirements and place orders."

NEW PRICES OF LARGE INCANDESCENT LAMPS

Detailed Prices of Mazdas and Graphitized Filament Units, as Effective Jan. 1, Grouped According to Regular Schedules

Following the exclusive announcement in last week's ELECTRICAL WORLD of the advance in the prices of incandescent lamps, effective Jan. 1, 1918, the appended tables give the price schedules complete on large Mazda and graphitized-filament units. The prices are arranged according to regular schedules, which are as follows:

Schedule 1—Mazda lamps for standard lighting service—straight-side and pear-shape bulbs—110 to 125 volts.

Schedule 2—Mazda lamps for standard lighting service—straight-side and pear-shape bulbs—220 to 250 volts.

Schedule 3—Mazda lamps for ornamental-lighting service—round and tubular bulbs—110 to 125 and 220 to 250 volts.

Schedule 4—Mazda vacuum lamps for sign-lighting service—straight-side bulbs—11 to 12½, 55 to 65 and 110 to 125 volts.

Schedule 5—Mazda vacuum lamps for electric street railway service—straight-side bulbs—for use five in series on 525, 550, 575, 600, 625 or 650-volt circuits.

Schedule 6—Mazda gas-filled lamps for use in series on street-lighting circuits—straight-side and pear-shape bulbs—lamps rated at 5.5, 6.6, 7.5, 15 and 20 amp.

Schedule 7—Mazda lamps for train-lighting and locomotive-headlight service—straight-side and round bulbs—5½ and 6, 30-34 and 60-65 volts.

Schedule 8—Mazda lamps for use with country-home lighting outfits—straight-side and pear-shape bulbs—16-cell (28-32 volts).

Schedule 9—Mazda daylight lamps—pear-shape bulbs—110 to 125 volts.

Schedule 10—Mazda gas-filled lamps—concentrated filaments for focusing purposes—round bulbs—5½ and 6, 30-34 and 110 to 125 volts.

Schedule G—Graphitized-filament lamps for standard lighting service—110 to 125 volts.

INCANDESCENT-LAMP PRICES, JAN. 1, 1918

				List Price	
Schedule 1—	Volts	Watts	Bulb	Clear	Frosted
Mazda B	100-130	10 & 15	S-17	$0.30	$0.33
Mazda B	100-130	25-40-50	S-19	0.30	0.33
Mazda B	100-130	60	S-21	0.35†	0.39†
Mazda B	100-130	100	S-30	0.70	0.77
Mazda C	100-130	75	PS-22	0.70	0.75
Mazda C	100-130	100	PS-25	1.10	1.15
Mazda C	100-130	200	PS-30	2.20	2.27
Mazda C	100-130	300	PS-35	3.25	3.35
Mazda C	100-130	400	PS-40	4.30	4.45
Mazda C	100-130	500	PS-40	4.70	4.85
Mazda C	100-130	750	PS-52	6.50	6.75
Mazda C	100-130	1000	PS-52	7.50	7.75
Schedule 2—					
Mazda B	200-260	25 & 50	S-19	0.35	0.38
Mazda B	200-260	100	S-30	0.85	0.92
Mazda B	200-260	150	S-35	1.30	1.40
Mazda B	200-260	250	S-40	2.20	2.35
Mazda C	200-260	200	PS-30	2.40	2.47
Mazda C	200-260	300	PS-35	3.90	4.00
Mazda C	200-260	400	PS-40	5.10	5.25
Mazda C	200-260	500	PS-40	5.60	5.75
Mazda C	200-260	750	PS-52	7.70	7.95
Mazda C	200-260	1000	PS-52	9.00	9.25
Schedule 3—					
Mazda B	100-130	15 & 25	G-18½	0.50	0.53
Mazda B	100-130	15-25-40	G-25	0.50	0.55
Mazda B	100-130	60	G-30	0.70	0.77
Mazda B	100-130	100	G-35	1.00	1.10
Mazda B	100-130	25	T-10	0.55	0.60
Mazda B	100-130	25-40	T- 8	1.00	1.10
Mazda B	200-260	25-50	G-25	0.60	0.65
Schedule 4—					
Mazda B	10-13	2½ & 5	S-14	0.27	0.30
Mazda B	50-65	5	S-14	0.30	0.33
Mazda B	100-130	10	S-14	0.30	0.33
Schedule 5—					
Mazda B	525-650	23-36	S-19	0.30	0.33
Mazda B	525-650	56	S-21	0.35	0.39
Mazda B	525-650	94	S-24½	0.70	0.77
Schedule 6—	Amp.	Cp.			
Mazda C	5.5	60	S-24½	1.00*	1.05*
Mazda C	5.5	80-100	S-24½	1.20*	1.25*
Mazda C	5.5	250	PS-35	2.35*	2.45*
Mazda C	5.5	400	PS-40	4.00*	4.15*
Mazda C	6.6	60	S-24½	1.00*	1.05*
Mazda C	6.6	80-100	S-24½	1.20*	1.25*
Mazda C	6.6	250	PS-35	2.35*	2.45*
Mazda C	6.6	400	PS-40	4.00*	4.15*
Mazda C	6.6	600	PS-40	5.00*	5.15*
Mazda C	7.5	60	S-24½	1.00*	1.05*
Mazda C	7.5	80-100	S-24½	1.20*	1.25*
Mazda C	7.5	250	PS-35	2.35*	2.45*
Mazda C	7.5	400	PS-40	4.00*	4.15*
Mazda C	7.5	600	PS-40	5.00*	5.15*
Mazda C	15	400	PS-40	4.00*	4.15*
Mazda C	20	600	PS-40	5.00*	5.15*
Mazda C	20	1000	PS-40	6.00*	6.15*
Schedule 7—	Volts	Watts			
Mazda B	25-34	10-15-20	S-17	0.30	0.33
Mazda B	25-34	25 & 50	S-19	0.30	0.33
Mazda B	25-34	10-15-20-25	G-18½	0.40	0.43
Mazda B	25-34	50	G-30	0.70	0.77
Mazda B	50-65	10-15-20	S-17	0.30	0.33
Mazda B	50-65	25 & 50	S-19	0.30	0.33
Mazda B	50-65	10-15-20-25	G-18½	0.40	0.43
Mazda B	50-65	50	G-30	0.70	0.77
Mazda C	5½ & 6	36	G-18½	1.35	...
Mazda C	5½ & 6	72	G-25	1.60	...
Mazda C	5½ & 6	108	G-30	1.90	...
Mazda C	30-34	100	G-25	1.50*	...
Mazda C	30-34	150	G-25	2.00*	...
Mazda C	30-34	250	G-30	3.00*	...
Schedule 8—					
Mazda B	28-32	5	S-14	0.30	0.33
Mazda B	28-32	10 & 20	S-17	0.30	0.33
Mazda B	28-32	40	S-19	0.30	0.33
Mazda C	28-32	50	PS-20	0.70	0.75
Mazda C	28-32	75	PS-22	0.80	0.85
Mazda C	28-32	100	PS-25	1.20	1.25
Schedule 9—					
Mazda C-2	100-130	75	PS-22	0.80	0.90
Mazda C-2	100-130	100	PS-25	1.25	1.35
Mazda C-2	100-130	150	PS-25	1.90	2.00
Mazda C-2	100-130	200	PS-30	2.50	2.64
Mazda C-2	100-130	300	PS-35	3.75	3.95
Mazda C-2	100-130	500	PS-40	5.50	5.80
Schedule 10—					
Mazda C	100-130	100	G-25	1.50	...
Mazda C	100-130	250	G-30	3.00	...
Schedule G-1—					
Gem	100-130	20 & 30	S-17	0.22	0.24½
Gem	100-130	40-50-60	S-19	0.22	0.24½
Gem	100-130	60 mill type	S-19	0.22	0.24½
Gem	100-130	50	G-25	0.27	0.30

*Same as previous list price. †Reduced list price.

WHERE THE BOILER-ROOM DEVICE MARKET IS HEADING

Trend Indicated by Census Statistics Shows on Analysis How Rapidly "Rented Power" Is Superseding "Owned Power"

The United States census data show that in 1889 only 2 per cent of the total power in the country was "rented power," that is, central station power. In 1904 this ratio had increased from 2 per cent to 3.3 per cent. In 1909 it was 9.4 per cent, and in 1914 it was 17.4 per cent. During the same period and for the five-year intervals above named the electric-motor rating in active service practically doubled with each five years. Since the last five-year census report the greatest three years of industrial activity this country has ever seen have been experienced. Not only has the total of active power-generating apparatus been increasing at a terrific rate, but the gain in the central station percentage column has been progressing by stupendous strides owing to slow deliveries of prime movers and high fuel prices. According to close observers it is entirely safe to estimate that the census report of 1919 will show that 33 per cent of the total power is rented power.

If viewed in their relation to the so-called boiler-room device market, these facts point to a decreasing demand among isolated power plants and an increasing demand for the same or similar equipment among owners of large power-producing companies. The total volume of trade, however, will probably diminish owing to the very large number of isolated plants now going over to central station service. Besides, considerably fewer of the new plants are installing their own generating systems owing to two fundamental factors, (1) inability to obtain satisfactory delivery of plant equipment, and (2) the seriousness of the fuel situation.

METAL MARKET SITUATION

Copper Not Being Hoarded—Stranded Wire Not Equal to Demand—Better Supply of Tin Probable

According to the most reliable sources of information there is no likelihood of the government advancing the price of copper, or of there not being enough metal to meet all urgent needs. Consequently there is no disposition to acquire copper or hoard it for future contingencies. There is a strong demand for wire, and deliveries are none too satisfactory in standard sizes. The stranding machines have not been able to keep up with the demand for the last three years. Rubber-covered as well as slow-burning wire is commanding the greatest attention and largest sale at the present time.

With no tin offering, the price remains nominal. From official reports a large supply may reach the American market from the Straits via the Pacific route, by an arrangement with Great Britain. The latter has now prohibited the sale of zinc, brass, lead and nickel. Copper, steel and iron were already on the prohibited list.

NEW YORK METAL MARKET PRICES

	Dec. 24	Dec. 31
Copper:	£ s d	£ s d
London, standard spot	110 0 0	110 0 0
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	27.00	27.00
Lead, trust price	6.25	6.25
Nickel, ingot	50.00	50.00
Sheet zinc, f.o.b. smelter	19.00	19.00
Spelter, spot	7.67½	7.82½ to 7.92½
Tin, Straits	85.00*	85.00*
Aluminum, 98 to 99 per cent	34.00 to 36.00	34.00 to 36.00

OLD METALS

Heavy copper and wire	22.00 to 22.50	22.00 to 22.50
Brass, heavy	14.00 to 15.00	14.00 to 14.50
Brass, light	9.50 to 10.50	10.00 to 10.50
Lead, heavy	5.75 to 5.87½	5.75 to 6.00
Zinc, old scrap	5.00 to 5.50	5.00 to 5.50

*Nominal.

THE WEEK IN TRADE

THE predictions that the sale of holiday specialties would shrink this year has proved unfounded, for the volume in some sections exceeded previous records. In others it equaled that of the year before. Shortages on wire, heavy motors, conduit, etc., are reported in spots, with other staple stocks in satisfactory condition. Everything possible on order was shipped in from the manufacturers and prominent distributers to jobbers and dealers before the books were closed.

A lull has followed the usual stress of selling on the Christmas account, and inventories have occupied the attention of every branch of the trade during the week. Some increases in price have materialized, and others are contemplated with more than a fair chance of realization in the near future. Shipments still are delayed by the embargoes and freight congestion. The governmental railroad control is expected to mitigate the situation in due course.

Trade financial affairs are stated to be in excellent condition. Collections have figured on a basis apparently up to expectations. No loose rein is being drawn on credits.

NEW YORK

With the opening of the new year there is every indication that business will improve in the greater distribution and sale of electrical merchandise. Jobbers and dealers are still busy with inventories. Orders placed with manufacturers and primary distributers for early delivery cover a wide range of products, chiefly staples. The last week in the year is always quiet, and there was no exception for 1917.

New prices on a higher level went into effect on several items on Jan. 1, and prior thereto, and there is a possibility of further announcements to the same effect. The market is restless on this score.

Financially the trade is in a sound condition, with collections making a new record and credits in good shape.

PANELS.—A new line of panels will be brought out by a manufacturer with the first of the year. The announcement covers about a half dozen types, with a range of prices in accordance with the models and finish. Quotations have not changed on the regular lines.

FANCY FIXTURES.—Goods of the fancy or decorative type in lighting fixtures were expected to advance in price around Jan. 1. Of course, should this prediction prove well founded, it will be due to the feverish condition of the metal market.

CROSS-ARMS.—On Dec. 17 an advance of 10 per cent was declared. Deliveries are tightening up. The congressional committee investigation of the lumber situation has hastened the placing of orders for early delivery, if such a thing be possible. This is tying up the situation.

MOTORS.—From fractional sizes up to 40-hp. motors an increase in price is looked for, but it is uncertain. It may come along any time, Jan. 1 being the date originally fixed for the notice. There is an acknowledged falling off in the buying of these types at present. Shipments are reported as extremely poor.

COLLECTIONS AND CREDITS.—The wind-up of the year and the start of 1918 find collections in a very fair condition. Credit authorities state that no relaxation on their part will be visible for an indefinite period. The "slacker" has no standing whatever.

GLASS INSULATORS.—With an advance of 12½ per cent last month the supply and delivery of insulators is fair. The coal situation is tending to slow up production at the glass factories. The high cost of fuel has caused the elevated price.

PORCELAIN.—The government is reported as having requisitioned everything in porcelain goods. Consequently there is something of a shortage in sight.

RADIATORS.—With the zero weather prevailing during the past week, the demand for radiators and all heating devices was abnormal. The heaviest stocks in the hands of the jobbing distributer were drawn down, and hurried calls for fresh and rush supplies to the factories were made. Large shipments were immediately placed in transit and hurried forward to relieve the market.

HOUSEHOLD SPECIALTIES.—An advance of 8 to 8½ per cent on portable sewing machines and about 10 per cent on washing machines is reported as coming on Feb. 1. A rumor which has been gaining momentum, that domestic heating appliances were to be increased in price Jan. 15, will doubtless be fulfilled in the near future, according to authoritative information. The size of the addition, it is stated, will be dependent on the metal situation, condition of stocks, and other market contingencies.

CHICAGO

The trade generally is resting on its oars after the spurt required to keep pace with the lively holiday trade which developed just before Christmas. Inventories are being taken, and, as is the custom, these are being allowed to occupy practically the entire attention of both the distributers and retailers. Several organizations are also taking advantage of the quiet condition of affairs to hold sales meetings, also giving out-of-town representatives an opportunity to spend the holidays in the city. Probably the feature of the week may be said to be the announcement that lamp prices will be increased.

CHRISTMAS RETAIL TRADE.—The holiday trade was not up to last year's volume. The buying was slow until the last few days before Christmas; then a rush started which lasted until the doors closed on Christmas Eve. A peculiar feature of the buying was that when it did start it was particularly active in the higher-priced appliances. Percolators, sewing-machine motors and all sorts of household devices were in good demand. In some quarters the opinion is given that the holiday trade this year was 20 per cent under what it was last year.

JOBBERS' INVENTORIES.—It is the opinion that the inventories of jobbers' stocks will show values above normal. It is probable that the volume of stock now on the jobbers' shelves is very little in excess of normal. Such items as are carried in more than normal quantities are goods that it seems expedient to carry on account of delivery situations.

CHRISTMAS-TREE LAMPS.—The complaints from purchasers of Christmas-tree lamps last year were numerous. This year they were more numerous. Filament trouble caused this unduly large amount of dissatisfaction. Just blame can hardly be placed on the lamp manufacturers, however, for they have had their troubles in the miniature-lamp field, mostly through no fault of their own.

COPPER WIRE.—Jobbers are on a 35-cent base, with some manufacturers quoting a trifle lower.

CONDUIT.—There are still some stocks of conduit, but the question of the jobbers replenishing them is occupying attention.

LAMPS.—The announcement of a 10 per cent increase in lamp prices was accepted in the most part with the statement that the manufacturers deserved credit for refraining so long from raising prices in the face of rising labor and material costs.

FUSES.—The purchases of fuse companies in the Middle West recently by other fuse companies in the field is said in no way to presage a decrease in prices. It is said in some quarters that the prices of fuses will probably be higher before they are lower.

CREDITS AND COLLECTIONS.—There is very little activity this week, the disposition being to let things slide until the first of the year.

GLASS INSULATORS.—The glass-insulator business is now in such shape that some manufacturers are able to ship orders on the day received, if necessary.

COFFEE-URN HEATERS.—Orders for coffee-urn heaters have been coming in with regularity and in larger quantities than ever before.

BOSTON

Jobbers and retailers generally report an excellent volume of Christmas trade, but possibly from 10 to 15 per cent below last year in holiday specialties and heating appliances. The final week's business was about the same as a year ago. The usual pre-New Year lull followed the holiday. Jobbers and wiring contractors report a very active industrial business, and government work appears to be increasing in volume. House wiring is practically at a standstill, except in repair and alteration jobs, which are giving some of the smaller contractors much-needed work. At Lewiston, Me., shipbuilding is causing active house wiring, however. Collections are reported slower from contractors and central stations, but very good from mill customers. The outlook is clear for a year of extreme activity along war-business lines, including auxiliary productive work closely related to government needs.

Prices remain firm, and deliveries, it is anticipated, will improve somewhat, in priority classes, at any rate, as the result of government control of the railroads. Transportation companies will now be entering the market for supplies through government financing and supervision, and the electrical industry will undoubtedly benefit from their improved status. Curtailment of service of a non-essential character by public utilities has begun, and is likely to increase during the winter. Jobbers' stocks are understood to be large in most lines; the lamp situation is improving, and manufacturers are beginning to accumulate stocks of standard equipment in many lines.

LAMPS.—Supply conditions are better in standard lines. The Westinghouse Lamp Company lost about 500,000 lamps in a recent Boston fire, but about seven carloads of lamps were rushed to Boston, and by to-day it was expected that the situation would be greatly improved. The policy of lamp producers of caring for customers' present needs and discouraging hoarding is bearing fruit.

PORTABLES.—Many of these were moved in the Christmas trade, though the volume of business done fell below last year. Dealers are now well stocked with modern designs for all-the-year-round business. Prices remain unchanged.

CONDUIT.—Jobbers appear to be well stocked at this time, especially in the smaller sizes. There is some reason to hope for better transportation conditions under government control of railroad service, but how much improvement is possible remains to be demonstrated.

WIRING MATERIAL.—Supplies are fairly plentiful in jobbing circles, especially in smaller and lighter products. War work dominates the industry.

WIRE AND CABLE.—Business is falling off a little in the market for the smaller sizes of wire and cable. Factory stocks are beginning to accumulate in these sizes. Deliveries are improving a little on heavier cable, and prices remain steady. The government will be in the market for such material for arsenal, shipyard and naval service for some time to come.

MOTORS.—Raw materials are a little easier in the motor factories. Shipments have not begun to improve much, however. Stocks are uncertain as to regularity of sizes. The demand continues very heavy and prices hold firmly. Even the optimists see little prospect of an early reduction in motor costs.

ATLANTA

The President's recent expression regarding the railroad problem was favorably received in this section, and a feeling of relief is felt by the business interests. The period of suspense is broken and the transportation situation clarified, at least from the viewpoint of railroad financial interests. Express and railroad embargoes have delayed the delivery of a large quantity of electrical equipment shipped from Eastern and Northern points, but even in the face of this condition an improvement is noted in the shipments of a few staples. The volume of business transacted this week is very light, owing

to the fact that the greater portion of the time will be consumed for inventory purposes.

A great amount of activity is being centered at South Florence (Muscle Shoals), Ala., the site of the government nitrate plant. Approximately $30,000,000 will be spent at this point, and a large electrical supply business is anticipated. The labor situation at present is fairly stable, with the exception of the conditions existing at Gulfport, Miss. The cutting of wires between Pass Christian and Orange Springs prevented the Gulfport and Mississippi Coast Traction Company from serving these points temporarily.

Sales ardor has been somewhat dampened in this section owing to the very acute fuel situation and protracted drought. A number of industrial plants have had to shut down for various periods, and a few central stations suffered power curtailment on account of the fuel shortage. Decreasing water reserve at hydroelectric plants operated by the Southern Power Company, Georgia Railway & Power Company, Columbus Power Company and Central Georgia Power Company has developed into a curtailment and temporary shutdown of customers served by some of the above companies. It is reported that the shortage of both fuel and water has compelled the Central Georgia Power Company, Macon, Ga., to curtail its service to six hours per day. Lack of water at its Tallulah Falls (Ga.) plant compelled the Georgia Railway & Power Company to shut down 150 of its hydroelectric power customers twenty-four hours last week. Essential industries, such as municipal plants, fire pumps and plants working on government war orders, were permitted to operate.

LAMPS.—The trade has received notice of an advance of approximately 10 per cent in price on standard Gem and Mazda lamps to take effect Jan. 1.

RUBBER-COVERED WIRE.—A large quantity of No. 8 down to No. 4/0 solid has been purchased this week from local stocks for steel interests in the Birmingham district, and it is reported that options have been secured on stock replacements now en route. Local stocks are much lower than last week.

SEATTLE

The Pacific Northwest's first war Christmas established a record for holiday trade. However, the effect of the war was shown in buying. The greatest demand was for practical gifts, and electrical dealers generally agree that the sales of Christmas gifts along electrical lines, such as irons, percolators, toasters, stoves, lamps and sewing machines, has never been equaled. However, the usual slump in both retail and wholesale business following a holiday is now being experienced. This slump, of course, pertains particularly to sales of energy-consuming devices by wholesaler to retailer and then to customer.

The volume of business at shipyards and industrial plants was nearly as large as preceding weeks, but sales to mills and camps decreased appreciably, the latter owing to inclement weather and partial Christmas shutdowns.

Stocks of energy-consuming devices are very low owing to the heavy drain preceding the holidays. Dealers are hastening to replenish these stocks, fearing they may be placed on the non-essential list. Shortages of certain kinds of wire, heavy motors, conduits, etc., still obtain.

Reports from three large Northwest cities indicate a noticeable increase in the construction of fireproof buildings. This increase has not been especially noticeable in Seattle. During the past week orders were received from Washington for the erection of additional cantonment buildings at Vancouver, Wash., also at the mouth of the Columbia River, in addition to those recently erected at Forts Stevens, Columbia and Canby, in Oregon. Retailers report a noticeable increase in the sales of fixtures and wiring devices, this being aside from pick-up work at various cantonments.

The erection of a gigantic steel and pig-iron manufacturing plant on Puget Sound is vouched for by the authorities, who assert that construction will commence as soon as permission to buy necessary machinery and equipment is obtained from the General Defense Board. The reported initial units of the plant will cost $9,000,000 and the fully completed project approximately $25,000,000. The establishment of the plant will mark the beginning of the greatest period of industrial development the Northwest has ever known and will presage the location of numerous industries utilizing steel as raw material.

Recently contracts for twenty steel steamships of 8800 tons capacity, to cost approximately $40,000,000, were awarded to Portland shipbuilders by the United States Shipping Board. These are the first contracts granted the steel shipyards in Portland.

The freight situation is still in a chaotic condition, but recently, as the result of a conference between the railroad and steamship lines, an arrangement has been made which, it is believed, will relieve the congestion of Oriental freight.

SAN FRANCISCO

Christmas trade in electrical goods was disappointing in that it fell below expected volume. All branches of the electrical industry in San Francisco agree on this, and one large jobbing house estimates the volume of Christmas sales as 25 per cent below the amount expected. It is evident that purchases are being made with care. The sale of motor-driven household appliances has been very good, and the preference generally has been for labor-saving devices.

The machine shop and iron workers' strike now in effect has cut down the production of fixtures and accessories used in the electrical trade and has also temporarily closed down considerable construction work. However, government contracts are not being interfered with. Government action in taking over the railroads has had no effect on the Pacific Coast field. On being asked for an opinion on this point some of those who order large freight consignments stated that if any changes occur as a result of this action they are most likely to be beneficial. Because of the time allowance which Pacific Coast dealers are accustomed to make on Eastern orders, the time in transit is a smaller factor in delivery quotations than in the case of Eastern cities. Only recently have delays in transit been added to factory delays in making delivery quotations, and it is hoped that traffic plans as revised under government supervision may improve this condition.

Contractors continue to find fairly good business in industrial work and on construction contracts in interior towns. Shipbuilding activity is calling for a constant supply of materials, but local jobbers are concerned over the announcement that the United States Shipping Board plans to place orders with manufacturers. There is a question as to whether this plan would be at all feasible on the Pacific Coast.

Applications for rate increases have been filed with the railroad commission by several of the larger light and power companies, and pending decisions on these questions extension of generating plants is being limited to the actual necessity to supply present demands. In fact, some important developments have been stopped because of high prices of labor and equipment until some corresponding rate adjustment is probable.

Credits and collections are in good shape. Special care is usually exercised as books are opened for the new year, but collections have been good and there is no reason for drawing credits tighter.

LAMPS.—While not supplying the demand, manufacturers and jobbers are taking care of customers' actual needs. There have been heavy orders placed recently because of the announced increase in retail price, which took effect on Jan. 1. The demand for carbon lamps has been heavier because of the heavy industrial demand. For example, one large San Francisco plant has an average of several hundred lamps a week required to supply breakage alone.

CONDUIT.—Galvanized conduit stocks continue in bad shape. No price changes have occurred recently, but there is some anticipation of a rise in the near future.

GLASS INSULATORS.—For telephone and telegraph lines glass insulators are expected to increase in price again in January. There was a 10 per cent increase in price on this line in December. Stocks are fair to good, but deliveries are very bad.

INSULATED WIRE.—Both weatherproof and rubber-covered have shown a tendency to decrease in price, but stocks are still in poor condition.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B.&S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 Solid
Less than coil....List to $61.00
Coil to 1000 ft....10% to $59.17

No. 12 Solid
Less than coil....List to $71.00
Coil to 1000 ft....10% to $68.87

Twin-Conductor

No. 14 Solid
Less than coil....List to $105.00
Coil to 1000 ft....$70.00 to 10%

No. 12 Solid
Less than coil....List to $135.00
Coil to 1000 ft....10% to $130.95

DISCOUNT—CHICAGO

Single-Conductor

No. 14 Solid
Less than coil....List +10%
Coil to 1000 ft....List —10%

Twin-Conductor

No. 14 Solid
Less than coil....+10%
Coil to 1000 ft....—10%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg....List to 10%
1/5 to std. pkg....15% to 20%
Std. pkg....28% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg....+20% to 12%
1/5 to std. pkg....List to 20%
Std. pkg....28% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28 to .285	28 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.3175	.3275
Barrel lots	.2875	.2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, Per 100 Ft.
5/16	250	$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25–50	35.00
2	25–50	45.00
2 1/2	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/4-in. s. stp.	Net to $75.00	—15% to $69.75
3/4-in. d. stp.	+5% to 75.70	— 9% to 72.00
1/2-in. s. stp.	List to 100.00	—15% to 93.00
1/2-in. d. stp.	List to 100.00	— 9% to 96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/4-in. single strip	$75.00	$63.75
3/8-in. double strip	71.25	71.75
1/2-in. single strip	100.00	85 00
1/2-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32	$0.05 1/2	1	$0.25
1/4	.06	1 1/4	.33
3/8	.09	1 1/2	.40
1/2	.12	1 3/4	.47
5/8	.15	2	.55
3/4	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.— $25.00-$55.00	$20.50-$24.75	$20.00-$22.00
1/4-in.— $28.00-$60.00	$22.50-27.00	$22.00-$24.00

NET PER 1000 FT.—CHICAGO

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in., Net to..	$55.00	$25.00-$37.50	$22.50-$24.75
1/4-in., Net to..	$60.00	$27.00-$30.00	$25.00-$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4	$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37
2 1/2	.58 1/2
3	.76 1/2

	Couplings, List	Elbows, List
1/4	$0.05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	4% to 6%	7% to 9%
2500 to 5000 lb.	6% to 9%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	1.3% to 3.7%	4.3% to 6.7%
2500-5000 lb.	3.3% to 5.7%	6.3% to 8.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price....$5.00 to $6.00
Discount....25% to 30%

CHICAGO

List....$5.00 to $6.00
Discount....25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg....28%
1/5 to std. pkg....38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg....28%
1/5 to std. pkg....38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.00 to $5.75
1/5 to std. pkg.	4.50

Standard package, 500. List, each, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard package, 500. List, each, $0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.30
60-watt—B	100	.35
100-watt—B	24	.70
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round bulbs, 3¼ in., frosted:		
15-watt—G 25	50	.55
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.77
Round bulbs 4¾ in., frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $31.00
Coil to 1000 ft.	$25.50 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $36.56
Coil to 1000 ft.	22.30 to 27.42

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	$20.00 to $29.00

CHICAGO

Net per 100	$19.25 to $24.00

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200 S.E., 300, AX, 1½, 4 S.	30.00
103—C.A., 9, 4R. B 1½	25.00
106—F.A., 7, C.S. 1½, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25-30%	20-32%
$10.00 to $50.00 list	42%-45%	37%-40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

Per 1000 Net	
Less than 1/5 std. pkg.	$20.00 to $38.00
1/5 to std. pkg.	19.00 to $20.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80
1/5 to std. pkg.	14.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000 5½ N. C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$27.50 to $29.00	$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000 5½ N.C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$11.85	$30.75
1/5 to std. pkg.	11.10 to 11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push sockets	500	$0.33
¼-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net to 14%
1/5 to std. pkg.	15% to 30%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	List to + 5%
$10 to $25 list	11%
$25 to $50 net	14% to 15%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16%
$25 to $50 list	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+5%
$10 to $25 list	—10%
$25 to $50 list	—14%
	Low Grade
Less than $10 list	—5%
$10 to $25 list	—16%
$25 to $50 list	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to —15%
Std. pkg.	List to —30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	List	List to + 10%
$2.00 to $10.00 list	10% to 20%	5% to 10%
$10.00 to $50.00 list	20% to 30%	15% to 25%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25%	15% to 20%
$2.00 to $10.00 list	25%	20%
$10.00 to $50.00 list	25% to 35%	20% to 25%

TOASTERS, UPRIGHT

NEW YORK

List price	$5.00 to $7.50
Discount	25% to 30%

CHICAGO

List price	$5.00 to $6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net.
No. 18, less than full spools.	$0.44¼ to $0.49
No. 18, full spools.	0.43¼ to 0.45

CHICAGO

	Per Lb. Net.
No. 18, less than full spools.	$0.57½ to $0.65
No. 18, full spools.	0.50½ to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net—		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
11	$15.00-$18.00	$13.00-$14.00	$11.25-$11.50
12	23.25- 27.09	21.30- 23.22	19.35- 20.85
10	32.40- 37.80	29.70- 32.40	27.00- 29.25
8	45.70- 53.34	41.90- 45.73	38.00- 41.38
6	72.40- 84.42	72.36- 72.40	60.30- 65.50

CHICAGO

	Price per 1000 Ft. Net—		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$18.00	$13.50	$12.00
12	26.95-27.79	23.41-26.95	19.85-23.10
10	33.24-38.25	30.47-32.27	27.70-30.60
8	47.04-54.27	43.12-46.43	39.20-43.42
6	68.25-92.61	62.05-79.23	55.85-74.09

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$35.25 to $40.00
25 to 50 lb.	36.25 to 39.00
50 to 100 lb.	34.25 to 38.00

CHICAGO

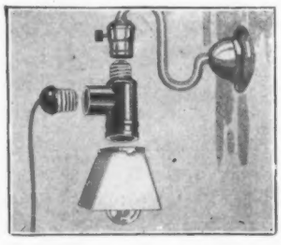
	Per 100 Lb. Net
Less than 25 lb.	$40.00 to $40.35
25 to 50 lb.	39.00 to 39.35
50 to 100 lb.	38.00 to 38.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Plural Plug Socket

The Central Telephone & Electric Company of St. Louis, Mo., is distributing the plural plug socket shown herewith. The device has a hard-rubber composition covering which has a highly polished finish of black. By use of this appliance the lamp is left in the original position and the use of a shade is permitted.

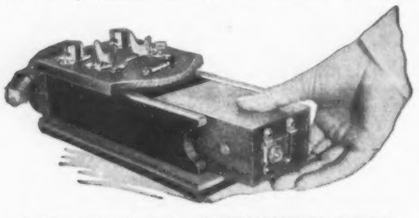


PERMITS USE OF A SHADE

Testing Device for Automobiles

A testing device developed to facilitate the testing and adjusting of the Ford coil unit and for testing automobile lamps of any candlepower or voltage, electric horns, spark plugs, for finding short circuits, grounds, etc., and for starting Ford engines in cold weather, has recently been put on the market by the Jefferson Electric Manufacturing Company of Chicago. One of the most important features of this tester is the fact that it tests the Ford coil unit under alternating current. The Ford coil is wound for and operates in actual service under alternating current.

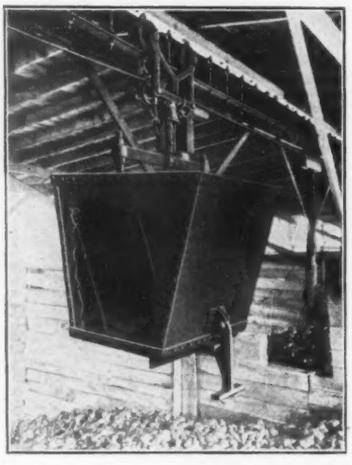
The No. 28 tester is designed for use with an alternating-current lighting circuit, while the No. 30 tester is identical in every respect with the No. 28, with the exception that it is designed for use where alternating current is not available and receives its energy from a 6-volt storage battery or four dry cells. The tester is assembled in a highly polished mahogany case. All metal parts are heavily nickeled, presenting a very handsome appearance. The No. 28 is equipped with an extension cord and plug so as to attach it conveniently to any alternating-current lighting circuit.



FORD UNIT AND COMBINATION TESTER

Coal-Handling Device

John F. Godfrey of Elkhart, Ind., has developed a method of unloading coal adapted from the hay carrier device. A bucket of 1-ton capacity is used, which is dropped into a pit at the side of the railroad track and filled from a chute which receives the coal from the hopper bottom of the car. The bucket is hauled up an inclined track, being supplied with trunnion rollers at each side which operate upon the track, and is lowered upon the top of the pile or bin. A trigger releases the bottom of the bucket and the weight of the coal causes the bucket to empty, when the spring bottom immediately closes and is ready for another load. In order to get the bucket back to the starting point a double-drum arrangement and a double pulley on the carrier are used. This device has a capacity of unloading about three cars in eight hours.



TWO-WAY REVERSIBLE CARRIER

Socket and Plug

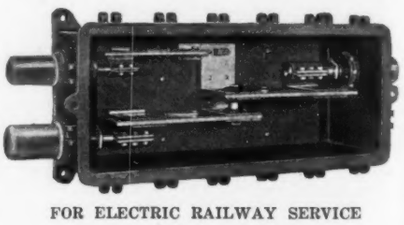
A new General Electric Company wiring device consists of a multi-catch pull socket and swivel attaching plug with current tap. This device can be screwed into a socket and an electrical portable such as fan motor, piano lamp, etc., attached by means of a current tap without the loss of the light in the outlet.

Cable Junction Box

A cable junction box specially designed for electric railway service by the Standard Underground Cable Company of Pittsburgh, Pa., is shown in the illustration. Where feeder circuits are installed underground use of this box makes possible the disconnecting and sectionalizing of different parts of the circuit while alive by simply opening one or more of the quick-break knife switches. The box is mounted on the wall of the manhole and is rendered waterproof by means of liberal gaskets at all points. The cables enter the box through nipples which are mechanically connected to the lead cable sheath by a wiped soldered joint. The main feeder cable passes into the box through the nipples shown in the illustration at the right-hand end and at the lower left-hand corner. The nipple shown at the upper left-hand corner is for the side feed tap leading to the trolley wire.

The box is designed for use with main feeder cables up to 2,000,000 circ. mil. and for side tap feeders up to 500,000 circ. mil. The two quick-break switches in the main feeder circuit each have a current-carrying capacity of 1000 amp. and that in the side tap circuit a capacity of 400 amp. All live parts in the box are mounted on non-inflammable insulating material and separated by ample air gaps.

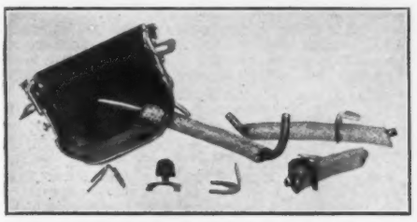
A very important advantage in the design of this junction box is the patented bimetallic nipple. The rigid portion of this nipple is brass and the malleable portion lead. The wiped joint is therefore made between the lead of the nipple and that in the cable sheath, which method requires much less heat and less skill than in making a similar joint between brass and lead. The nipple is also designed to permit all cable connections to be made away from the box where there is more room to work and no metal wall to conduct the heat from the parts to be joined. After all connections are made to the cable the nipple is inserted and clamped in position by means of a nut on the inside of the box.



FOR ELECTRIC RAILWAY SERVICE

Flexible Tubing Fastener

The Hyatt Electrical Works, Sacramento, Cal., has developed a fastener for flexible tubing such as is illustrated herewith. It is claimed that this device holds the tubing with a greater degree of positiveness, is more readily installed and takes up less space in the box than



OCCUPIES SMALL AMOUNT OF SPACE

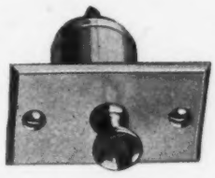
other fasteners. The device is designed for use on ⅛-in., 7/32-in. and ¼-in. (3.2-cm., 5.6-cm. and 6.4-cm.) sizes of tubing. When used on the ¼-in. (6.4-cm.) size the tongue should be bent to be at right angles to the body of the clamp.

Combination Electric Dishwasher and Table

An electric dishwasher which when not in use forms a convenient kitchen table is being manufactured by the William Campbell Company of Detroit, Mich. The tank in which the washing is done is lined with tinned copper and the soap and water which performs the cleansing operation is agitated by a motor-driven paddlewheel. The cost of operation, according to the manufacturer, averages about 1 cent per hour. Three quarts (2.8 l.) of water is used for each washing operation. The outfit is mounted upon a substantial steel frame. Aluminum is used for the covering of the table top. The weight of the apparatus ready to ship is 165 lb. (74.8 kg.).

Lighting Switch

A lighting switch designed primarily for use on gasoline and electric motor cars has recently been developed by the Industrial Controller Company of Milwaukee, Wis. A single unit of the switch is shown in the accompanying illustration. The switch is of the push-and-pull type and arranged so that when the handle is pushed the circuit



FOR MOTOR CARS

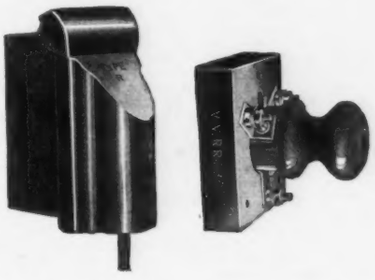
is open and when it is pulled the circuit is closed.

These switches are made with a round metal cylinder or barrel, which permits of round holes being drilled or bored in the dash. The front or face plates are furnished to correspond with the number of switches in the gang they are used with. These plates are made of heavy metal, have beveled edges and are furnished in various finishes, such as nickel, brushed brass, dull black, etc.

The handle is of metal, larger in size than those ordinarily used and designed so that it may be easily gripped. There are no fiber parts whatever used in the construction of this switch, the insulated moving contact piece being of bakelite, into which the brass parts are molded. The shaft carrying the moving contact extends clear through the switch and is supported at both ends, thereby assuring proper alignment. These switches are furnished in units or in gangs of several switches. They are also furnished for dimming the headlights, either by inserting resistance in series with the lights or by the series-parallel control method.

Receptacle Plug and Box

A heavy-service receptacle mounted in a neatly finished cast-iron box was recently placed on the market by the V. V. Fittings Company of Philadelphia. The box is waterproof, arranged with a gravity closing lid which remains closed whether the plug is in or out. The receptacle is made of



WEATHERPROOF BOX AND RECEPTACLE WITH PLUG

heavy slate thoroughly insulated from the box. The receptacle sits at an angle in order to permit an easy connection and disconnection of the plug. The binding posts for connecting wires are easily accessible, and plenty of room is allowed for wiring. The plug is made of wood so as to stand rough handling and is arranged so that the polarity cannot be reversed.

The complete outfit is made in two-pole, three-pole, and four-pole designs for 30-amp. and 60-amp. ratings. It is made especially for outdoor work for use with portable motors, coal hoists, shipyards, boat-loading machinery, moving-picture machine outlets, etc.

Electrically Heated Auto Primer

An electrically heated primer for automobiles, which both heats the fuel and atomizes it by air, has been placed upon the market by the Master Primer Company, 1523 Fort Street West, Detroit, Mich. Connected to the carburetor, the heating coil is suspended in a small reservoir of gasoline above which is a small air vent. The outlet is controlled by a lever which operates a valve at the connection to the intake manifold. The same lever makes electrical contact and opens the air vent.

MOTOR SECURES ONLY A HEATED MIXTURE OF AIR AND GASOLINE

With the throttle of the carburetor closed, nearly all of the suction of the motor applies directly on the primer. The motor thus secures only a heated mixture of air and gasoline.

Tests made by the Detroit Testing Laboratory show that the heating coil raises the temperature of the gasoline at the rate of 14 deg. Fahr. (10 deg. C.) per second. Considering that many cars start easily at a temperature of 40 deg. Fahr. (4.4 deg. C.) and nearly all of them at 60 deg. Fahr. (15.6 deg. C.) the primer should start any car in zero weather within three to five seconds. The manufacturer states that tests in cold-storage plants at from —10 deg. to —25 deg. Fahr. (—23.3 deg. to —31.7 deg. C.) indicate that cars actually start in less than seven seconds.

Current Tap

Harvey Hubbell, Inc., of Bridgeport, Conn., is placing on the market a pull-socket current tap. The device is of the same mechanical construction as the ordinary pull socket to which has been added a plug receptacle built into the side of the body. It can be supplied with a ⅛-in., ¼-in., ⅜-in. (3.2-cm., 6.4-cm., 9.5-cm.) or pendent cap. The flow of current to the lamp base is controlled by the pull chain. The terminals of the receptacle are continuously in circuit.

The use of this socket eliminates the

PULL-SOCKET TYPE OF CURRENT TAP

annoyance of a long cord running from a side-wall outlet. Current can be supplied directly beneath the fixture to operate the various table electrical appliances now in general use without the need of sacrificing the use of the light.

New Incorporations

THE WAYLAND (MICH.) ELECTRIC LIGHT & POWER COMPANY has filed articles of incorporation with a capital stock of $5,000.

THE HAROLD (S. D.) LIGHT & POWER COMPANY has been chartered with a capital stock of $12,000 by P. J. Suhn, Harry Weeney and David Miller.

THE PEOPLE'S ELECTRIC & GAS COMPANY of Okmulgee has been incorporated with a capital stock of $75,000 by A. B. De Fresse, G. Ortman and Harlan Read.

THE MONARCH STORAGE BATTERY COMPANY of Grand Rapids, Mich., has filed articles of incorporation with the Secretary of State. The company is capitalized at $20,000.

THE PORT ARTHUR (TEX.) TELEPHONE COMPANY has been chartered with a capital stock of $100,000 by R. S. Shipley, J. W. Williams of Port Arthur and P. K. Higgins of Liberty, Mo.

THE WINDSOR ELECTRIC COMPAN of Steubenville, Ohio, has been incorporated with a capital stock of $10,000 by H. M. Daugherty, R. L. Buffington, F. T. Wagenhals, E. S. Brown and R. F. Rarey.

THE CROMBIE LABORATORIES, Inc., of Port Chester, N. Y., have been incorporated with a capital stock of $25,000 for the purpose of conducting a research laboratory for investigating chemicals and electrical properties.

THE ELECTRIC WELDING COMPANY OF AMERICA of New York, N. Y., has been incorporated with a capital stock of $1,000,000 by W. Schenstrom, J. Kjedstad, and E. Schwarz, 415 Knickerbocker Avenue, Brooklyn, N. Y.

THE WHITNEY-McNEILL ELECTRIC COMPANY of Augusta, Ga., has been chartered with a capital stock of $6,000 to manufacture and deal in electrical fixtures. The incorporators are: J. B. Whitney and Joseph B. McNeill.

THE A. & C. MANUFACTURING COMPANY of Yonkers, N. Y., has been chartered with a capital stock of $9,000 by E. J. and C. R. Abraham of Yonkers. The company proposes to manufacture electrical and gas appliances.

SHAPIRO & ARONSON of New York, N. Y., have filed articles of incorporation with a capital stock of $250,000, for the purpose of manufacturing gas and electrical fixtures. The incorporators are: D. Shapiro, I. Kaplan and J. Pecker, 1890 Douglass Street, Brooklyn, N. Y.

THE WRIGHTSTOWN UTILITIES CORPORATION of Asbury Park, N. J., has been incorporated with a capital stock of $25,000 to generate and distribute electricity, etc. The incorporators are: A. F. Cottrell, J. P. Watson and J. C. English, all of Asbury Park.

THE AUTOMOBILE ELECTRIC EQUIPMENT COMPANY of Wilmington, Del., has been incorporated by C. L. Rimlinger, M. M. Clancy and C. M. Enger of Wilmington, Del. The company is capitalized at $100,000 and proposes to manufacture and install electric storage batteries.

THE CARLSBAD (N. M.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $150,000 to construct and operate an electric-light plant in Carlsbad. The incorporators are: Mary E. Tansell of Olympia, Wash.; Herbert W. Tansell and Helen S. Tansell of Carlsbad.

THE ELECTRIC FARM & LIGHTING POWER COMPANY of Antigo, Wis., has been incorporated by R. P. Brown, John H. Walechka and J. T. Brown. The company is capitalized at $25,000 and proposes to manufacture individual or isolated light and power plants and systems and other electrical equipment.

THE DODD WILLIAM MANUFACTURING COMPANY of Jersey City has been incorporated with a capital stock of $250,000 by Josiah D. Grummon, of New York, N. Y.; Charles E. Corbin of Rahway, and Edwa A. Markley of Jersey City. The company proposes to manufacture mechanical and electrical appliances.

THE ROYALTY PRODUCTION COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $500,000. The company proposes to acquire patents for exploitation of an electrical device to increase the production of oil, etc. The incorporators are: F. D. Buck, M. L. Horty and J. D. Frock, all of Wilmington, Del.

THE PAN-AMERICAN WIRELESS TELEGRAPH & TELEPHONE COMPANY has been incorporated with a capital stock of $50,000, with no par value, by interests connected with the Marconi Wireless Telegraph company for the purpose of extending the activities of the latter company. The officers are: John W. Griggs, chairman of board; Edward J. Mally, president; Washington Dodge, vice-president; C. J. Ross, secretary, and John Bottomley, treasurer.

Trade Notes

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., has been elected to membership in the Rice Leaders of the World Association.

MACGOVERN & COMPANY of New York City have increased their capital from $150,000 to $200,000. The growth of the company's business has been phenomenal.

THE ESTERLINE COMPANY of Indianapolis, Ind., announces the removal of the offices of James G. Biddle & Company, representatives of the New York territory of the Esterline Company, from 90 West Street to 15 Park Row.

FRED R. FARMER succeeded Frank S. Beardslee as president of the Beardslee Chandelier Manufacturing Company on Jan. 1. Mr. Beardslee remains with the company as chairman of the board of directors. In the past year Mr. Farmer has been sales manager of the Gibson Company, Indianapolis, Ind.

THE INTERNATIONAL SIGNAL COMPANY, Brooklyn, is the title of what was formerly the National Electric Signaling Company, the receivership of which has been amicably adjusted and closed. The International company will continue the manufacture and operation of radio-telegraph and radio-telephone apparatus under patent rights of the original company.

A. H. MEYER has been appointed general manager of the Bryan-Marsh Lamp Division, Chicago. Upon graduation from the University of Nebraska in electrical engineering in 1909 he was employed in construction work for a few months, after which he became manager of city sales at the Chicago office of the Bryan-Marsh Company, with which company he has been continuously since that time.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY of New York City on Feb. 1 will remove from 114 Liberty Street to 243 and 245 West Seventeenth Street. The company will occupy the store and basement, which runs through the block to Eighteenth Street. The new quarters will afford ten times the room the company now occupies, and it is arranging to carry that much increased stock of its specialties for the jobbing trade.

THE CROCKER-WHEELER COMPANY of Ampere, N. J., to meet unusual conditions incident to the war through Dr. Schuyler S. Wheeler, president, on Dec. 27 announced a bonus under which its employees will receive not less than 10 per cent of their wages since Oct. 1, 1917, and during the coming year. All employees receiving less than $2,500 yearly will benefit, and those who have been in the employ of the company for more than a year will receive 12 per cent of their earnings.

THE CHICAGO FUSE MANUFACTURING COMPANY announces that it has purchased the entire renewable-fuse business of the Multi Refillable Fuse Company, makers of the well-known line of multi-refillable fuses. This transaction includes the conveyance of all merchandise, materials, machinery, tools, designs, patents, good will and unfilled orders, and hereafter these fuses will be manufactured and marketed solely by the Chicago Fuse Manufacturing Company under its trade name "Union." The Chicago Fuse Manufacturing Company will still continue with its line of non-refillable fuses, thereby being in a position to furnish either type of fuse as desired by the trade.

C. T. McDONALD, president and manager of the Multi Refillable Fuse Company, announces that he has disposed of his interest in that company, and after Jan. 1 will devote his entire attention to the Multi Electrical Manufacturing Company at 703 Fulton Street, Chicago. The new company will manufacture and market a complete line of slate base cut-outs and fittings, wire bushings and conduit fittings under the trade name "Multi." Mr. McDonald has been associated with the manufacture of these and kindred electrical supplies during the last fifteen years, and announces that it will be the policy of this company to merchandise its product through agents in different communities.

Trade Publications

SOCKETS.—"Quick Catch" sockets are illustrated and described in a circular issued by Harvey Hubbell, Inc., Bridgeport, Conn.

RADIATOR.—The Willis Manufacturing Company of Cleveland, Ohio, is distributing a folder descriptive of its portable electric nitrogen radiator.

PRIMER.—The Master Primer Company of Detroit, Mich., has prepared a folder descriptive of its Master primer with an electrically heated vaporizer.

VACUUM CLEANERS—The Wise McClung Manufacturing Company of New Philadelphia, Ohio, has issued a folder on its American electric vacuum cleaner.

REHANDLING BUCKET.—The Blaw-Knox Company of Pittsburgh, Pa., has prepared a folder giving information regarding its "Blaw" speedster rehandling bucket.

TOGGLE SNAP SWITCHES.—Harvey Hubbell, Inc., of Bridgeport, Conn., has prepared bulletin No. 16-2, descriptive of its Hubbell surface-type toggle snap switch.

STEAM TURBINE LUBRICATION.—The Moore Steam Turbine Corporation of Wellsville, N. Y., has issued a bulletin on the subject of correct steam turbine lubrication.

POWER-PLANT EQUIPMENT.—Bulletin No. 66, descriptive of power-plant equipment for immediate shipment, has been prepared by the Ross Power Equipment Company, Merchants' Bank Building, Indianapolis, Ind. This bulletin, which is dated Dec. 15, 1917, lists electrical equipment, steam units and miscellaneous items.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY of Plainville, Conn., has just distributed a new bulletin covering its "safety service" knife-switch line and a line of inclosed switches that are not externally operated. The line is complete, covering all general requirements. The two features that are especially emphasized in the design of the "safety service" are, first, that the box cannot be opened until the switch is disconnected, and, second, that when opened the switch cannot be connected until the cover is closed. With these two features no operator at any time can come in contact with a live closed switch.

CABINETS.—The Benjamin Electric Manufacturing Company of Chicago has just prepared its bulletin No. R-2, descriptive of Benjamin-Starrett cabinets. This bulletin is a necessary supplement, it is said, to the Benjamin-Starrett panelboard catalog, S-2. The listings in that book include cabinets, but only so far as certain combination list prices of panelboards complete with cabinets are concerned. Numerous listings in catalog S-2 are for panels only. It was, therefore, left to this bulletin to describe and illustrate cabinets alone for "RA," "SA," "SB," "RG" and "SG" panels and "R" and "S" standard panelboards. Diagrams, illustrations and full data on how the panels are mounted, together with a description of the special mounting plates, are given.

STEEL POLES.—The Bates Expanded Steel Truss Company, 208 South La Salle Street, Chicago, is distributing its 1918 edition "Steel Pole Treatise." This volume contains various valuable data and simplified formulas for steel-pole work. The latter portion of the treatise is devoted to simplified mathematical formulas for computing various pole-line stresses, information that should be in the hands of every construction engineer. Valuable wire data to be used in connection with the mathematical formulas and various other purposes are included. Precise dimensions of original sections before they are sheared and expanded into the poles, together with compilations of the strength of these beams unexpanded when used as beams, girders and columns, are given. A list of users of Bates poles is also included. An interesting article regarding 2500 Bates steel poles recently furnished the city of Chicago is included, as is a brief description of the company's Italian undertaking where a plant at Savona, Italy, is now being built. The index is as follows: "Trolley Poles and Fittings." "Power Transmission Poles and Fittings." "Lighting Poles and Fittings." "Combination Structures." "Method of Manufacture." "Tests." "Bates 'H' Sections." "Simplified Mathematical Formulas," "Comparison of Bates Expanded Steel Poles and Tubular Steel Poles." "Prices of Poles." "Pole Fixtures and Fittings." "Wood Pole Decay," "Pole Capacities," "Modern Pole Line Sense," "Concrete Setting," "Valuable Wire Data." "Resultant Force." "A Few Users of Bates Poles," "Street Signs," "Pole Climbers," "Outdoor Substations," "Inquiry, Suggestions," etc.

New England States

PORTSMOUTH, N. H.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 14 for furnishing one electric freight elevator of 2 tons capacity for building No. 45 at the navy yard, Portsmouth, N. H. Drawings and specifications (No. 2730) may be obtained on application to the above bureau or to the commandant of the navy yard named.

LYNN, MASS.—The General Electric Company has begun work on the construction of its proposed new factory buildings at West Lynn, two of which will be one and two stories, about 25 ft. by 50 ft., and a new administration building, about 70 ft. by 340 ft.

Middle Atlantic States

ANDOVER, N. Y.—Plans are being considered by the town officials of Andover for the construction of a municipal electric-lighting plant.

BUFFALO, N. Y.—Plans are being prepared by the New York Central Railroad Company for the construction of a new power house in Curtiss Street, to cost about $20,000.

HORNELL, N. Y.—The City Council has applied to the Public Service Commission for permission to construct and operate a municipal electric-light plant in Hornell.

MONTOUR FALLS, N. Y.—The Shepard Electric Crane & Hoist Company has filed a notice of increase in capital stock with the Public Service Commission from $500,000 to $1,000,000 for expansion.

NEW YORK, N. Y.—Contract has been awarded by the E. Greenbaum Company, 349 East 103d Street, New York City, to the W. K. Moran Company, 405 Lexington Avenue, for the installation of new power equipment and a new heating system at its packing houses at 320 East 103d Street.

NEW YORK, N. Y.—Plans have been filed and contract awarded by the New York Edison Company for the erection of a one-story addition to its transformer station on Park Avenue, near 149th Street. Plans have also been prepared for the erection of a one-story storehouse at the same location. The Louis Weber Building Company, 171 Madison Avenue, has the contract.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 14 for a new electric-lighting system for the extension of machine shop building, No. 128, at the Navy Yard, New York, N. Y. Drawings and specifications (No. 2728), may be obtained on application to the above bureau or the commandant of the navy yard named.

NIAGARA FALLS, N. Y.—To assure the adequate supply of electric power for establishments engaged in war work at Niagara Falls and Buffalo, the United States government has requisitioned the energy generated and distributed by the Niagara Falls Power Company, the Hydraulic Power Company of Niagara Falls and the Cliff Electrical Distributing Company. It is not expected that operation of mills will be affected materially by the new order as readjustment of the power supply has been arranged previously by the representatives of the War Industries Board.

RIVERHEAD, N. Y.—The Long Island Lighting Company of Northport is reported to be negotiating for the purchase of the property of the Riverhead Electric Light Company.

SOUTHAMPTON, N. Y.—The stockholders of the Suffolk, Light, Heat & Power Company have voted to sell the plant and holdings to the Long Island Lighting Company of Northport, which has also recently acquired the electric-light plants at Sayville, Islip, Babylon and Farmingdale.

SYRACUSE, N. Y.—The New York Central Railroad Company has awarded contract for the erection of a new power house (one-story, 25 ft. by 35 ft.) at its West Side yards, to W. M. Ballard, Oneida, N. Y.

CAMDEN, N. J.—An appropriation of $110,400 as provided for in the annual budget for 1918, including $13,900 for the Electrical Bureau and $96,500 for electric lighting, has been approved by the City Council.

GLOUCESTER, N. J.—Plans have been prepared by the Bell Telephone Company, 1230 Arch Street, Philadelphia, Pa., for the erection of a new exchange plant in Gloucester.

MORRISTOWN, N. J.—The Board of Public Utility Commissioners has granted the Morris County Traction Company permission to issue $1,179,000 for extensions and improvements to its system.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

MORRISTOWN, N. J.—The Morris & Somerset Electric Company, 20 South Street, has been awarded contract for supplying electricity to operate the proposed new aluminum bronze works, to be erected in Morristown by Charles Butters of Oakland, Cal.

NEWARK, N. J.—The Public Utility Commission has approved the application of the Public Service Railway Company for permission to issue $1,250,000 in capital stock, the proceeds to be used for plant extensions.

NEWARK, N. J.—Permission has been granted the New York Telephone Company by the Township Committee of Hillside, near Newark, to erect poles in Myrtle Avenue, to provide for extensions to its system in the Hillside district.

NEWARK, N. J.—Bids will be received by the Board of Freeholders for the installation of new electric-lighting and power wiring in the laundry building at the Essex County Hospital at Overbrook. The board is also considering plans for improvements to the electric-lighting system and the installation of new boilers at the hospital.

TRENTON, N. J.—The City Commission is considering plans for improvements to the electric street-lighting system, including extensions in Nassau, Dexter and Vine Streets and Phillips Avenue, in the North Trenton district.

TRENTON, N. J.—The Mercer County Board of Freeholders has awarded contract for lighting the Lee and Olden Avenues, Chambers and Southard Streets and the Perdicaris Place bridges to the Public Service Corporation for a period of five years.

BRADFORD, PA.—Plans have been filed by the Kendall Refining Company for the erection of a new two-story power house, 40 ft. by 75 ft., at its works in the East Bradford district. Contract has been awarded to W. I. Uhruh, 574 East Main Street, Bradford.

ERIE, PA.—Plans have been filed by the General Electric Company for the construction of a new power house at its local works, for which contract has been awarded to Henry Shenk, Twelfth and Sassafras Streets, Erie.

ERIE, PA.—Three large housing projects to cost approximately $6,000,000, it is reported, are under consideration by the American Brake Shoe & Foundry Company, the General Electric Company and the Erie Forge Company to provide accommodations for their employees.

NANTICOKE, PA.—Plans are being prepared for the construction of several extensions to the State Hospital at Nanticoke, including a new one-story power house. McCormick & French, Second National Bank Building, Philadelphia, Pa., are architects; Dr. E. D. Meyer, West Washington Street, Nanticoke, is superintendent.

NORRISTOWN, PA.—Improvements are being made to the local system of the United Telephone & Telegraph Company, including the installation of a new switchboard.

PHILADELPHIA, PA.—Plans are being prepared by Shane Brothers & Wilson, Bourse Building, for the construction of a new one-story power house, about 35 ft. by 40 ft., at its plant at Sixty-third and Market Streets. J. M. Whitham of Philadelphia, Pa., is architect.

POTTSVILLE, PA.—The Pottsville Union Traction Company has filed notice with the Public Service Commission of an issue of $10,000 in bonds for extensions and improvements to its system.

POTTSVILLE, PA.—Notice has been filed with the Public Service Commission by the Eastern Pennsylvania Light, Heat & Power Company of an issue of $10,500 in bonds, the proceeds to be used for improvements.

READING, PA.—The Public Service Commission has granted the Reading Transit & Light Company permission to arrange for an appropriation of $150,000 for extensions and improvements to its system.

WHITE HAVEN, PA.—Plans have been prepared by the Wilmot Engineering Company of Hazleton for extensions to its plant at White Haven, to include a machine shop, pattern shop and power station. The company manufacturers iron and steel castings, coal mining machinery, breakers, etc. George W. Wilmot is president.

WILKES-BARRE, PA.—The main power station of the Wilkes-Barre Company on North River Street at the city line is being enlarged to provide space for new equipment, including new switchboard, two boilers of 600 hp. each and a new 5000-kw. turbine. The company will also erect a new high-tension transmission line from Wilkes-Barre to Hudson and vicinity. This line will supply energy to the colliery of the Quinn Coal Company and other industries along the line.

BALTIMORE, MD.—Plans are being prepared by Gardner & Lindberg, of Chicago, Ill., for the erection of a new power house at the works of Corkran, Hill & Company on Sixth Street, near Wilkens Avenue. The office of the company is located at 221 South Howard Street.

BALTIMORE, MD.—Plans have been filed by the Bartleet-Hayward Company, Scott and McHenry Streets, for the construction of a new transformer house at Ramsay and Poppleton Streets. Contract has been awarded to Morrow Brothers, Fidelity Building, Baltimore, Md.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 21 for the installation of radio towers and tank at Bartaria Bay, La., to cost about $35,000. Further information may be obtained at the above bureau.

WASHINGTON, D. C.—Plans are being prepared by McKenzie, Voorhees & Gmelin, 1123 Broadway, New York, N. Y., for the construction of a new telephone building for the Chesapeake & Potomac Telephone Company at Thirteenth and G Streets, N. W. The cost is estimated at about $800,000.

North Central States

CLEVELAND, OHIO.—The New York Central Railroad Company is planning to erect a power house, 40 ft. by 79 ft., in Cleveland. New equipment, including generators, motors, etc., will be purchased. For further information address W. Brahan, East Third and St. Clair Streets.

TOLEDO, OHIO.—The City Council has granted the Mutual Heating & Lighting Company a franchise to lay conduits in Michigan Street, from Jackson to Lafayette Street.

JACKSON, KY.—The power plant of the Jackson Light & Ice Company was recently damaged by fire. The boilers alone escaped injury.

CABERY, ILL.—Bonds to the amount of $4,500 have been voted for the installation of an electric-lighting plant.

HOMER, ILL.—The property of the Homer Electric Light & Power Company has been purchased by J. M. Copel and T. E. Hughes of Champaign. The plant also furnishes electrical service in Sidney.

JOLIET, ILL.—The Chicago & Joliet Electric Railway Company is contemplating the construction of two substations, to cost about $50,000. One will be erected at Osgood and St. Louis Streets, and the other at Delwood Park.

MATTOON, ILL.—The Central Illinois Public Service Company has petitioned the Illinois Public Utilities Commission to abandon heating plants operated by the company in Charleston, Virden, Carrollton, White Hall and Moweaque. The petition is based upon the high cost and scarcity of coal and also the increased cost of other materials, making the heating service in the towns mentioned unprofitable.

WYOMING, ILL.—The Illinois Public Utilities Commission has granted the Public Service Company of Northern Illinois authority to purchase and operate the property of the Stark County Electric Company.

AMHERST, WIS.—The Amherst Electric Service Company, it is reported, contemplates extending its electric transmission line from Amherst to Amherst Junction.

IOLA, WIS.—The Iola Light, Power & Manufacturing Company, recently incorporated with a capital stock of $25,000, proposes to construct and operate a hydroelectric and auxiliary steam generating plant, saw and planing mill and other industries. Edwin J., George, Bertha and Erna Nehls are the incorporators.

STEVENS POINT, WIS.—Contract has been awarded by the Jackson Milling Company to the Allis-Chalmers Manufacturing Company of Milwaukee, for equipment for a hydroelectric power plant to be erected on the Wisconsin River at Stevens Point. The equipment will consist of six 950-hp. vertical open-flue hydraulic turbines directly connected to six 800-kva., alternating-current motors with governors, and two 200-kw. motor generator sets. The cost of the plant complete is estimated at $500,000.

CEDAR RAPIDS, IOWA.—The Board of Railroad Commissioners has granted the Iowa Railway & Light Company of Cedar Rapids a franchise to construct and operate an electric transmission line along certain roads in Benton County for the transmission of electricity for lamps, heaters and motors.

CEDAR RAPIDS, IOWA.—The Hubbard Ice Company is contemplating improvements to its ice plants at 1132 North First Street West and 519 Eighth Street West, to cost from $8,000 to $10,000. The company, it is reported, would like to receive bids on electric wiring. Rufus Lee, 1132 North First Street West, is manager.

EDDYVILLE, IOWA.—The City Council is considering calling an election to submit the proposal to issue $7,000 or $8,000 in bonds for improvements to the municipal electric-lighting system.

ST. LOUIS, MO.—The Laclede Gas Light Company is planning to establish a plant, at a cost of $400,000, to repair meters and motor cars.

ST. LOUIS, MO.—An ordinance has been introduced by the Board of Aldermen requiring the Union Electric Light & Power Company to replace all 32-cp. lamps with 60-watt Mazda lamps.

ST. LOUIS, MO.—The J. C. Bulis Manufacturing Company, 1122 South Twelfth Street, it is reported, is taking bids on two 80-hp., horizontal return boilers, boiler feed pump, steam heating, electric wiring and sprinkler system for a one-story building, 218 ft. by 391 ft., to be erected at Penrose, Geraldine and Brown Avenues. William Levy, Wright Building, is architect. The Flad & Humphrey Engineering Company, Chemical Building, is mechanical engineer.

FALLS CITY, NEB.—At an election to be held Jan. 15 the proposal to issue $60,000 in bonds for improvements to the municipal electric-light plant and $15,000 for the water works system will be submitted to the voters. E. M. Stevens, Ridge Arcade, Kansas City, Mo., is engineer.

OMAHA, NEB.—The Nebraska Service Station has awarded general contract for the construction of an auto service station to Alexander Beck, Keeline Bank Building. The company is receiving bids for electric wiring, heating and plumbing. The cost of the building is estimated at $32,000.

BURNS, KAN.—At an election held Dec. 27 the proposal to issue $10,000 in bonds, the proceeds to be used for the installation of a municipal electric-light plant, was carried.

FORD, KAN.—Bids will be received by the board of education, Ford, until Jan. 8 for the construction of a rural high school building, including steam heating, electric wiring, plumbing, etc. The cost of the building is estimated at $20,000.

GARFIELD, KAN.—Local business men have entered into a contract with the City Council of Larned for electricity from the municipal electric plant. The local company's transmission line will connect with the Larned system at the State Hospital for the Insane, 3 miles west of Larned, where the municipality furnishes electricity for the State buildings.

WICHITA, KAN.—Contract has been awarded by the Wichita-Walnut Valley Interurban Company for the construction of its proposed interurban railway to the Scott Construction Company of St. Louis, Mo. The line will extend from Wichita to Andover, thence to El Dorado and to Augusta.

WICHITA, KAN.—Bids will be received at the office of the board of education, Wichita, until Jan. 14 for the construction of two six-room additions, one to the Waco Ward School at Twenty-first and Waco Avenue, the other to the Horace Mann Intermediate School at Twelfth Street and North Market Streets. Separate bids to be submitted for heating and ventilating system, plumbing and electric wiring. Copies of plans and specifications may be obtained at the office of Lorentz Schmidt, architect, Wichita, upon deposit of $15.

Southern States

GRAPHITEVILLE, N. C.—The General Graphite Company, Jefferson Bank Building, Birmingham, Ala., it is reported, contemplates the construction of a hydroelectric plant in Graphite.

TUXEDO, N. C.—The Blue Ridge Power Company is planning to build a hydroelectric plant on the Green River, to develop from 8000 to 10,000 hp., at a cost of from $800,000 to $900,000. Contract for dam, 125 ft. high and 300 ft. long, has been awarded to Willard, Boggs & Company of Spartanburg, S. C., at $100,000. Designs for power house have not yet been prepared. The plans provide for the erection of an electric transmission line to connect Spartanburg, Inman, Campobello, Landrum, S. C., and Tryon and Saluda, N. C. All principal contracts, it is understood, have been placed. John A. Law of Spartanburg, S. C., is president.

COLUMBUS, MISS.—The Columbus Lumber Company is contemplating the installation of new equipment, including boilers, engines, locomotives, etc. The cost of the improvements is estimated at $70,000. D. F. McCullough is manager.

McCOMB, MISS.—The McComb & Magnolia Railway & Light Company is planning to build about 8 miles of track during 1918, to connect Summit, McComb, Fernwood and Magnolia.

WIGGINS, MISS.—The City Council has engaged Xavier A. Kramer, consulting engineer, Magnolia, to prepare plans for improvements to the electric-light plant and water-works system.

MOUNTAIN HOME, ARK.—A company, it is understood, has been organized to develop the water power on the North Fork River in connection with the erection of large smelters to work up large deposits of zinc and iron ores in north Arkansas and South Missouri. To meet the requirements of the proposed smelters it will be necessary to develop 3000 hp. E. N. Sanderson, 60 Broadway, New York, president of the Federal Light & Traction Company of Springfield, Mo., and others, are reported interested in the project.

ARDMORE, OKLA.—Contract has been let by George H. Siedehoff Construction Company of Kansas City, general contractor, to the Dodge Electric Company of Tulsa, for electric work for the Ardmore Hotel, to be erected in Ardmore, at a cost of about $200,000.

HOMINY, OKLA.—The installation of an electric lighting system is under consideration by the City Council.

PAULS VALLEY, OKLA.—The City Council is considering calling an election to vote on the proposal to issue bonds for improvements to electric-lighting system and water works.

BELTON, TEX.—The property of the Southwestern Traction Company, including the interurban line which runs between Belton and Temple, has been sold under the order of the United States Court, the purchaser being F. W. Downs of Temple, for $170,000, including mortgage bonds. The company, it is stated, will be reorganized and important improvements made to the property.

FORT WORTH, TEX.—The North Fort Worth Ice & Cold Storage Company is planning to install additional machinery in its ice plant at North Fort Worth, increasing the output by one-third.

GREENVILLE, TEX. — The Mineral Heights Street Railway Company is contemplating changing its system from overhead trolley to gasoline motive power.

MARFA, TEX.——The Marfa Electric & Ice Company is planning extensions to its light and power plant, including the installation of new equipment. The company which has also been granted a franchise to supply the city with water, will sink a number of wells and install pumps.

NAGOGDOCHES, TEX.—The City Council is planning extensions to the municipal electric-light and power plant, including the installation of a 300-kw., 2300-volt steam turbo-generator set, at a cost of about $14,000.

ORANGE, TEX.—The International Shipbuilding Company is planning to install a large electric carrying and mono-rail system in its local shipbuilding yards.

Pacific and Mountain States

OLYMPIA, WASH.—The Olympia Light & Power Company is installing a new 400-kw. alternating-current generator in its power plant.

OLYMPIA, WASH.—Owing to bids exceeding the funds appropriated for the construction of a new cottage and power plant at the State Training School for Girls at Grand Mound, the Board of Control has decided to drop the project for the present. The bids exceeded the appropriation by more than $12,000.

SEATTLE, WASH.—A bill has been passed by the City Council providing for an increase from $3,000,000 to $5,000,000 of the lighting fund utility bond issue for the purchase of a completed hydroelectric project. The bill will be an amendment to a bill passed by the Council early in 1917 directing the call of bids and an expenditure not exceeding $3,000,000.

SEATTLE, WASH.—The engineering department of the Puget Sound Traction, Light & Power Company is completing the installation of an additional penstock at the White River hydroelectric plant, which is about three-fourths completed. Foundations for the 16,000-kva. generator and waterwheel have been placed. The plant when completed will cost about $750,000.

SEATTLE, WASH.—The City Council has passed a bill appropriating $750 to send Hugh M. Caldwell, corporation counsel, and J. D. Ross, superintendent of lighting, to Washington, D. C., in the interests of the city, to bring about the cancellation of the rights of the Skagit Power Company to the Skagit River power site. The company was given rights on this site several years ago.

SEATTLE, WASH.—The City Utilities Committee has directed A. H. Dimock, city engineer, and J. D. Ross, superintendent of lighting, to make an investigation of the power project on the Snoqualmie Forest Reserve offered to the city by the Skyomish Power Company. The project is offered to the city for $800,000, and attention is called to the standing timber on the land, which can be disposed of while the dam is being built for $700,000. The site is 40 miles from Seattle and, it is understood, that an impounding basin can be developed with a capacity of 200,000 acre ft., or double the storage capacity of Cedar Lake after the new masonry dam is utilized. It is estimated that 40,000 (continuous) hp. can be developed.

BROOKDALE, CAL.—The Mountain Light & Water Company of Brookdale has petitioned the State Railroad Commission for permission to discard its flat rates and install meters in the residences of its patrons.

LOS ANGELES, CAL.—Plans for the completion of the municipal power plant No. 2 in San Francisquita Canyon to develop about 25,000 hp. are under consideration by Mayor Woodman and William Mulholland, chief engineer. The cost is estimated at $750,000.

LOS ANGELES, CAL.—The Board of Supervisors has adopted an ordinance granting the Pacific Electric Railway Company a franchise to construct and operate an electric railway on certain highways and public roads in Los Angeles County for a period of 40 years.

CARLSBAD, N. M.—The Carlsbad Light & Power Company is contemplating the installation of a steam auxiliary plant and proposes to use oil for fuel. The company would like to communicate with manufacturers and dealers in fuel oil equipment. H. Prithard is manager.

Canada

CALGARY, ALTA.—The purchase of a new automatic feed regulator, which will be required in connection with the contract to supply the Western Canada Flour Mills Company with energy is under consideration by the City Council. The cost is estimated at $2,750 and the commissioners will recommend that it be purchased from the Westinghouse Company. The company has decided to discard its steam plant and equip its works for electrical operation and has contracted for 800 hp.

TRAIL, B. C.—The West Kootenay Power & Light Company contemplates extending its electric transmission line to the property of the Canada Copper Company at Princeton a distance of 110 miles, to furnish electricity to operate the proposed 3000-ton concentrator which the company is planning to build. Plans are now being prepared by Bradley, Bruff & La Barthe of San Francisco, Cal., for the concentrator, to cost about $1,500,000.

BRUSSELS, ONT.—The Town Council is considering the installation of a new electric-light plant in the near future.

PARKHILL, ONT.—The Town Council is considering the installation of a hydroelectric power plant, to cost about $12,000.

PERTH, ONT.—The municipality is considering the purchase of the local electric plant, owned by the Canadian Electric & Water Power Company. The Hydro-Electric Power Commission of Ontario is planning the erection of a 26,400-volt transmission line between Perth and Smith's Falls to supply electricity to this town. It is proposed to change over the present generating stations and distribution system from 133 cycles to 60 cycles.

PICTON, ONT.—The Hydro-Electric Power Commission of Ontario is planning to furnish electricity in the towns of Picton, Wellington and Bloomfield, Prince Edward County, by means of a 44,000-volt transmission line from Trenton. The plans provide for the erection of a substation in Picton and also a substation in Wellington to serve the latter plant and Bloomfield, and the erection of a 4000-volt transmission line from Wellington to Bloomfield.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, A. H. Krom, 29 South La Salle St., Chicago. Annual meeting, May 14, 1918.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City. Annual meeting, Jan. 14, 1918.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary-treasurer, Roy B. Fowles, Pine Bluff, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, George C. Holberton, San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, McKeesport, Pa. Annual convention, September, 1918.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, W. L. Connelly, Gibson, Ind.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, R. B. W. Pirie, 406 Yorkshire Building, Vancouver, B. C. Annual meeting September, 1918.

CALIFORNIA ASSOCIATION OF CONTRACTORS AND DEALERS. Secretary, James W. Redpath, 505 Rialto Bldg., San Francisco, Cal.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, M. C. Gilman, Toronto Electric Light Company.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION N. E. L. A. Secretary, F. D. Beardslee, Union Electric Light & Power Co., St. Louis, Mo.

CONNECTICUT ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, George M. Chapman, Waterbury, Conn. Annual meeting, New Haven, Conn., May 1918.

EASTERN NEW YORK SECTION, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, Shiras Morris, Hart & Hegeman, Hartford, Conn.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL CREDIT ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert E. Elliott, 502 Flatiron Building, San Francisco.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago.

ELECTRIC VEHICLE SECTION OF THE N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla. Annual meeting, Jacksonville, Fla., Jan. 7, 1918.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, L. W. W. Morrow, Norman, Okla. Annual meeting, May, 1918, Oklahoma City.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, Dan Carey, Atlanta Builders' Exchange, Atlanta, Ga. Annual meeting June, 1918, Tybee Island, Ga.

ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, L. B. Van Nuys, Central Electric Co., Peoria, Ill. Annual meeting, Chicago, January, 1918.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, R. H. Abbott, Petersburg, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skillman, Indianapolis, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 111 Broadway, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

IOWA SECTION. N. E. L. A. Secretary-treasurer, L. E. Caldwell, Iowa City, Iowa.

JOVIAN ORDER. Jupiter (president). Henry J. F. Strickland, Dallas, Tex.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, R. M. Sutton, Wichita.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan. Annual meeting, Kansas City, Kan., Oct. 17-19, 1918.

KENTUCKY ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, F. F. Valinoti. Annual meeting, May, 1918, Louisville, Ky.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 323 Chartres St., New Orleans, La.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Augusta, Me.

MASSACHUSETTS ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, J. E. Wilson, 263 Summer Street, Boston, Mass.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Monroe, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, H. E. Young, Minneapolis General Electric Company, Minneapolis, Minn.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, G. M. Jones, 112 South Seventh St., Minneapolis, Minn. Annual convention, January, 1918, Minneapolis.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary-treasurer, W. F. Wheeler, Hattiesburg.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

MISSOURI ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo. Annual meeting Jan. 19, 1918.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass. Annual convention, New York, March, 1918.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, H. C. Brown, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill. Annual meeting, June 1, 1918.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York. Annual meeting, June 1918.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore. Annual meeting Sept. 11, 1918.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn. Annual meeting, Minneapolis, Minn., Jan. 23 and 24, 1918.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OREGON ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, J. W. Oberender, 302 Dekum Building, Portland, Ore. Annual meeting, September, 1918.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, Crossley Building, San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. State Section N. E. L. A. Secretary, H. M Stine, 211 Locust St., Harrisburg, Pa.

PENNSYLVANIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, M. G Sellers, 1518 Sansom St., Philadelphia.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston.

RADIO CLUB OF AMERICA. Secretary, T. J Styles, 152 Beech St., Yonkers, N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General Manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa. Annual meeting, Evanston, Ill., June, 1918.

SOUTH DAKOTA ELECTRICAL POWER ASSOCIATION. Secretary-treasurer, Frederick D Brown, Huron, S. D.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus, Ga.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 703 First National Bank Building, El Paso, Tex. Annual meeting, April, 1918.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, H. S. Ashley, Fort Worth, Tex. Annual meeting, Galveston, Tex., June 15, 1918.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. E. Myers, 3 Gould St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steigiltz, Columbia, S. C. Annual meeting, Charlotte, N. C., April, 1918.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt. Annual meeting, February, 1918.

VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 W. Jackson Blvd., Chicago, Ill. Annual meeting, Jan. 29-31, 1918, Memphis, Tenn.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis. Annual meeting, March, 1918.

WISCONSIN ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, J. C. Staff, 578 Jackson St., Milwaukee, Wis.

(Issued Dec. 11, 1917.)

1,249,583. TELEPHONE-EXCHANGE SYSTEM; Joseph L. Wright, Cleveland, Ohio. App. filed Dec. 9, 1912. Semi-automatic.

1,249,597. ELECTRIC OXIDIZER; David M. Clark, Phoenix, Ariz. App. filed Aug. 20, 1917. Improvements.

1,249,630. DOUGH RAISER; Colin F. Hardy, Harvard, Neb. App. filed March 20, 1916. Improvements.

1,249,638. ELECTRIC FLATIRON; Adele R. King, New York, N. Y. App. filed Feb. 10, 1917. Provided with cutout switches.

1,249,652. ELECTRIC LAMP; Joseph Mersing, Zollikon, near Zurich, Switzerland. App. filed May 10, 1916. Incandescent-filament type.

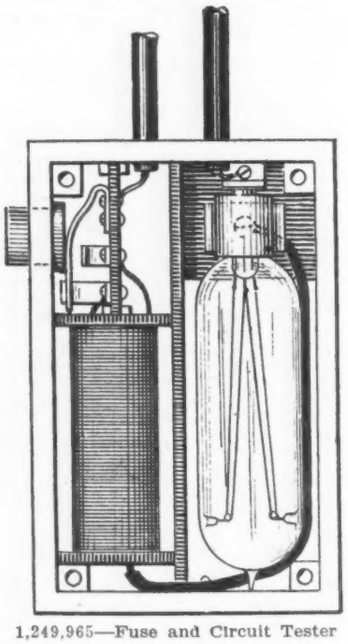
1,249,673. CIRCUIT-CONTROLLING DEVICE; Harry O. Rugh, Chicago, Ill. App. filed March 23, 1914. For use on signaling lines.

1,249,682. CONTROLLING SYSTEM FOR ELECTRIC ELEVATORS; William S. Smith, Cambridge, Mass. App. filed Feb. 5, 1916. Push-button system.

1,249,711. ELECTRIC CONNECTOR; John Berg, Chicago, Ill. App. filed Dec. 4, 1916. Improvement.

1,249,717. COMBINED FIRE ALARM AND ANNUNCIATOR; John Carrigan, Seattle, Wash. App. filed April 27, 1916. Improvements.

1,249,729. TROLLEY CATCHER; Charles I. Earll, New York, N. Y. App. filed April 20, 1916. Improvements.



1,249,965—Fuse and Circuit Tester

1,249,746. CONTROL APPARATUS; Arthur J. Hall, Wilkinsburg, Pa. App. filed Nov. 5, 1915. For use in multiple-unit control systems of electric vehicles.

1,249,747. CONTROL SYSTEM FOR ELECTRIC MOTORS; Arthur J. Hall, Wilkinsburg, Pa. App. filed Dec. 4, 1913. For a motor car or electric locomotive operated upon a direct-current railway system.

1,249,748. CONTROL APPARATUS; Arthur J. Hall, Wilkinsburg, Pa. App. filed Dec. 18, 1914. Special relation to means for lubricating the contact segments of drum controllers and the like.

1,249,773. TELEGRAPHY; Carl Kingsley, Chicago, Ill. App. filed Aug. 14, 1914. High speed.

1,249,782. BALANCED-PHASE-CONVERTER SYSTEM; Ralph R. Lawrence, Dorchester, Mass. App. filed July 24, 1916. Provides means for maintaining proper phase relations and voltage conditions in a polyphase circuit receiving current from or supplying current to a phase converter, particularly of the rotary type.

1,249,783. ROTARY-PHASE-CONVERTER SYSTEM; Ralph R. Lawrence, Dorchester, Mass. App. filed July 31, 1916. Provides means for maintaining, throughout variation in load, proper phase relations and voltage conditions in a polyphase circuit receiving current from or supplying current to a phase converter.

1,249,787. APPARATUS FOR ELECTRODEPOSITION OF METALS; August Leuchter, Brooklyn, N. Y. App. filed Oct. 5, 1916. Improvements.

Record of Electrical Patents

Notes on United States Patents

1,249,800. TRANSFORMER; Jesse E. Mateer, Wilkinsburg, Pa. App. filed Dec. 18, 1914. Means for insulating the high-tension coils.

1,249,820. INSULATOR; Harry A. Pharo, Wilkinsburg, Pa. App. filed Aug. 10, 1915. Means for supporting conductors securely without the use of tie wires or other external fastening means.

1,249,821. PROCESS OF MAKING CYANOGEN COMPOUNDS; Herbert Philipp, Perth Amboy, N. J. App. filed June 2, 1910. Improvements.

1,249,854. FURNACE FOR TREATING ORES; Gottwerth L. Tanzer, Seattle, Wash. App. filed July 24, 1917. Improvements.

1,249,856. CURRENT TAP; George B. Thomas, Bridgeport, Conn. App. filed Jan. 15, 1916. Associated with an electric lamp socket.

1,249,857. ELECTRIC SWITCH; George B. Thomas, Bridgeport, Conn. App. filed Sept. 9, 1916. Toggle.

1,249,866. ELECTRIC LEAD-IN FIXTURE; Alois F. Walther, Detroit, Mich. App. filed Sept. 2, 1916. For use in connection with garages and buildings.

1,249,872. ELECTRICAL SWITCH LOCK; Paul W. Wiggert, Idagrove, Iowa. App. filed July 10, 1916. Rotary members may be readily moved to inoperative position to prevent the switch from being closed except by a party familiar with the combination.

1,249,902. RAILWAY SIGNALING SYSTEM AND APPARATUS; Clyde J. Coleman, New York, N. Y. App. filed July 12, 1907. Improvements.

1,249,909. IGNITER FOR INTERNAL COMBUSTION ENGINES; James M. Dayton, Torrington, Conn. App. filed Sept. 26, 1914. Make-and-break type.

1,249,953. SPARK-PLUG TESTER; Claude E. Harlan, Watsonville, Cal. App. filed Feb. 19, 1916. Portable.

1,249,954. CONTROL SYSTEM; Rudolf E. Hellmun, Pittsburgh, Pa. App. filed Sept. 25, 1914. To prevent the occurrence of "flash-over" conditions in dynamo-electric machines, more particularly electric railway motors, under predetermined conditions.

1,249,962. TELEPHONE APPARATUS; Ludwig L. Lundgren, Youngstown, Ohio. App. filed May 3, 1915. Receivers.

1,249,965. FUSE AND CIRCUIT TESTER; Lynn D. Johnson, Portland, Ore. App. filed April 7, 1916. For electrician's kit.

1,249,978. INCANDESCENT LAMP; George M. J. MacKay, Schenectady, N. Y. App. filed Sept. 8, 1913. Tungsten.

1,249,982. MACHINE FOR SUBJECTING AIR TO CERTAIN LIGHT RAYS; Edwin M. Markel, Des. Moines, Iowa. App. filed Jan. 23, 1917. For producing ozone by the passage through the air of a brush electrical discharge generated in the machine.

1,249,992. CIRCUIT CLOSER FOR COMBINATION LOCKS AND BURGLAR ALARMS; Melvin D. Morton, Gauley Mills, W. Va. App. filed June 6, 1916. Improvements.

1,250,010. ELECTRIC ICE CUTTER; Germain Pouchan, San Francisco, Cal. App. filed March 29, 1915. Reducing ice to the shape of small blocks ordinarily cubical, suitable for use in restaurants.

1,250,080. SEPARABLE ATTACHMENT PLUG; Reuben B. Benjamin, Chicago, Ill. App. filed Nov. 21, 1908. Improved means for relieving the binding terminals from strain due to a pull on the conductors.

1,250,093. STEREOSCOPIC X-RAY APPARATUS; William D. Colidge, Schenectady, N. Y. App. filed March 3, 1915. Improvements.

1,250,105. TIMER; Clifton R. Holmes, Montgomery, Mich. App. filed Nov. 6, 1916. Improvements.

1,250,116. TELEPHONE-EXCHANGE SYSTEM; Charles L. Goodrum, Brooklyn, N. Y. Application filed Oct. 11, 1916. Improvements.

(Issued Dec. 18, 1917)

1,250,120. DECORATIVE ILLUMINATING MEANS; Alfred C. Abramson, Rockford, Ill. App. filed March 13, 1915. Portable lamps.

1,250,143. ELECTRIC SIGN; George S. Coleman, Newark, N. J. App. filed Oct. 21, 1916. Motion picture effect.

1,250,157. CONTROL DEVICE; Harry R. Fowler, Toledo, Ohio. App. filed May 20, 1915. Relates to interconnected elements of indication and operation.

1,250,183. ELECTROLYTIC CELL; Henry C. Jenkins, London, England. App. filed Nov. 22, 1916. An improved method of operating such cells.

1,250,209. INDICATING MECHANISM; Harry Y. Norwood, Rochester, N. Y. App. filed March 17, 1914. For indicating temperature.

1,250,385. ROTARY SPARK-GAP MACHINE; Clarence H. Teall, Detroit, Mich. App. filed Jan. 18, 1916. For use in connection with wireless apparatus.

1,250,402. ELECTRIC-HAMMER SWITCH; Alexander Wendelburg, New York, N. Y. App. filed July 28, 1914. Improved form of electric hammer.

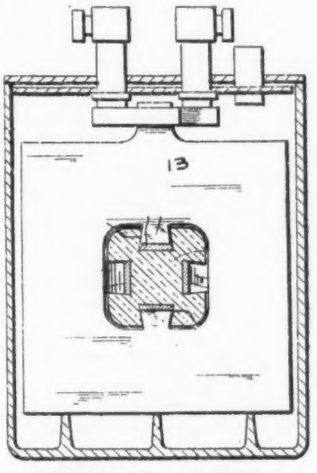
1,250,451. CARBURETOR ATTACHMENT; Linn B. Harrod, Little Rock, Ark. App. filed March 28, 1917. Improvements.

1,250,460. BATTERY CELL; Walter E. Holland, Detroit, Mich. App. filed March 15, 1915. Edison or alkaline type.

1,250,545. FLASHLIGHT; Bernard Benedict, New York, N. Y. App. filed Sept. 8, 1914. Portable.

1,250,554. APPARATUS FOR SEPARATING AND RECOVERING DOMESTIC REFUSE. App. filed March 21, 1916. Improvements.

1,250,579. MACHINE-SWITCHING TELEPHONE SYSTEM; Charles L. Goodrum, Brooklyn, N. Y. App. filed Oct. 6, 1916. Improvements.



1,250,696—Storage Battery

1,250,581. ELECTRIC FIXTURE; Gustav A. Harter, Chicago, Ill. App. filed June 22, 1914. Fixture in which a socket, globe and shade are freely adjustable to facilitate the installation thereof and to accommodate lamps of different sizes.

1,250,583. SEMI-AUTOMATIC TELEPHONE SYSTEM; Henry J. Herink, London, England. App. filed March, 8, 1917. In which there is a satellite exchange connected with a manual central exchange.

1,250,589. SIGNALING HORN; William Kaisling, Chicago, Ill. App. filed June 12, 1914. Provision of a new diaphragm-actuating mechanism for devices of this kind.

1,250,641. AUTOMATIC CONTROLLER; Hermann Pauli, Peoria, Ill. App. filed Oct. 24, 1914. Improvements.

1,250,661. SIGNAL FOR VEHICLES; Edwin H. Roberts, Denver, Col. App. filed Nov. 11, 1915. Operable from the steering wheel.

1,250,674. SWITCHING APPARATUS; William M. Scott, Tredyffrin Township, Chester County, Pa. App. filed Nov. 4, 1914. Suitable for the control of various current paths or circuits for producing desired effects upon or by translating devices included in such paths or circuits, or for simply interrupting or closing such paths or circuits.

1,250,696. STORAGE BATTERY; Edward E. Stout, Indianapolis, Ind. App. filed March 10, 1917. Means to equalize the distribution of the lines of force of the current through the battery elements.